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Flowing at work: Relationships of flow experience with teamwork and burnout symptoms

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Fabienne Aust

from Hagen (Germany)

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First referee: Prof. Dr. Corinna Peifer

Second referee: Prof. Dr. Thomas Franke

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List of Abbreviations

AB	absorption
ANS	Autonomic nervous system
BAT	Burnout Assessment Tool
BM	Burnout Measure
CBI	Copenhagen Burnout Inventory
CBT	Cognitive behavioral therapy
CFA	Confirmatory factor analysis
COM	Communication (subscale of the questionnaire of stressors and resources in teamwork)
CRM	Crew Resource Management
C-S	cross-sectional
CY	cynicism
DM	Decision-making (subscale of the questionnaire of stressors and resources in teamwork)
EE	emotional exhaustion
EN	enjoyment
ESM	Experience Sampling Method
EX	exhaustion
IM	intrinsic motivation
FFS	Flow Frequency Scale
FIRE	Feedback Instrument for Rescue Forces Education
FIS	Flow Intensity Scale
FKS	Flow-Short-Scale
FSS	Flow State Scale
HCC	hair cortisol concentration
HCN	hair cortisone concentration
HF	high-frequency
HPA	Hypothalamus-pituitary-adrenal
HRO	High reliability organization
HRT	High responsibility team
HRV	heart rate variability
ICD-10	International Classification of Diseases 10
ICD-11	International Classification of Diseases 11
JD-R	Job Demands-Resources

LI	longitudinal
LS	Leadership (subscale of the questionnaire of stressors and resources in teamwork)
M	mean value
MBI	Maslach Burnout Inventory
MBI-ES	Maslach Burnout Inventory - Educators Survey
MBI-GS	Maslach Burnout Inventory - General Survey
MBI-GS-D	Maslach Burnout Inventory - General Survey - German Version
MBI-SS	Maslach Burnout Inventory - Student Survey
N	sample size
NOS	Newcastle-Ottawa Quality Assessment Scale
NR	not reported
n.s.	not significant
O&C	Organization & Coordination (subscale of the questionnaire of stressors and resources in teamwork)
OLBI	Oldenburg Burnout Inventory
OLBI-S	Oldenburg Burnout Inventory - College Student
PA	personal accomplishment
PHQ-9	Patient Health Questionnaire (9 items)
PHQ-9-D	Patient Health Questionnaire (9 items) - German Version
PNS	parasympathetic nervous system
ProQOL	Professional Quality of Life Scale
PsyCap	Psychological capital
RMSEA	Root Mean Square Error of Approximation
RMSSD	Root Mean Sum of Squares of Successive Differences
RPA	reduced personal accomplishment
SD	standard deviation
SFPQ	Swedish Flow Proneness Questionnaire
SMM	Shared Mental Models (subscale of the questionnaire of stressors and resources in teamwork)
SNS	sympathetic nervous system
SRMR	Root Mean Square Residual
SUP	supporting behavior (subscale of the questionnaire of stressors and resources in teamwork)
T	Timepoint
TLI	Tucker-Lewis-Index

UWES	Utrecht Work Engagement Scale
vmHRV	vagially-mediated heart rate variability
WHO	World Health Organization
WOLF	Work-related Flow Inventory
WOLF-S	Work-related Flow Inventory - Study Questionnaire
X	independent variable
Y	dependent variable

List of Publications

The present thesis includes in addition to a general theoretical introduction and a general discussion, three peer-reviewed articles that are currently involved in the publication process (Study III) or are already published (Study I + II). They are listed below in order of appearance within the thesis. Only minor formatting changes have been made, e.g., to the font, tables, citation style, presentation of statistics, or figures, in order to achieve a consistent formatting style throughout this thesis.

In psychological research, it is habitual for co-authors to be involved in publications. All the co-authors are listed below. The contributions of the first author are described below.

Study I:

Aust, F., Heinemann, L., Holtz, M., Hagemann, V., & Peifer, C. (2023). Team Flow Among Firefighters: Associations with Collective Orientation, Teamwork-Related Stressors, and Resources. *International Journal of Applied Positive Psychology, 8*(2), 339–363. https://doi.org/10.1007/s41042-023-00093-7

Fabienne Aust developed the research question of the study presented in this manuscript under supervision of Prof. Dr. Corinna Peifer. Lena Heinemann, Maik Holtz and Prof. Dr. Vera Hagemann provided feedback during the conceptualization. Fabienne Aust performed the data collection together with Lena Heinemann and Maik Holtz. The study was integrated into the research project “Gemeinsam Stark – Teamtraining Brandbekämpfung”. Fabienne Aust conducted the data analyses under supervision of Prof. Dr. Corinna Peifer and with assistance of Lena Heinemann. Fabienne Aust drafted the manuscript. Prof. Dr. Corinna, Lena Heinemann, Maik Holtz and Prof. Dr. Vera Hagemann provided critical revision.

Study II:

Aust, F., Beneke, T., Peifer, C., & Wekenborg, M. (2022). The Relationship between Flow Experience and Burnout Symptoms: A Systematic Review. *International Journal of Environmental Research and Public Health, 19*(7). https://doi.org/10.3390/ijerph19073865

Fabienne Aust and Theresa Beneke developed the research model under the supervision of Prof. Dr. Corinna Peifer and Dr. Magdalena Wekenborg. Fabienne Aust and Theresa Beneke reviewed the manuscripts and compiled the data for the review. Fabienne Aust performed the analyses and compiled the synopsis of the data. Fabienne Aust drafted the manuscript. Prof. Dr. Corinna Peifer, Dr. Magdalena Wekenborg and Theresa Beneke provided critical revision.

Study III (under review):

Aust, F., Peifer, C., Handschuch, K., Rothe, N., Walther, A., Penz, M., Eder, J. & Wekenborg, M. K. (under review). Keep up the Flow: Investigating the Relationship between Burnout Symptoms and Flow Experience and its Psychophysiological Basis.

Fabienne Aust developed the research question, concept and design of the study presented in this manuscript under supervision of Dr. Magdalena Wekenborg and Prof. Dr. Corinna Peifer. She also performed the online data collection in 2021 with the assistance of Dr. Magdalena Wekenborg. The data of 2018 used in the study was collected by Dr. Magdalena Wekenborg, Nicole Rothe, Andreas Walther and Marlene Penz. Fabienne Aust conducted the data analyses under supervision of Dr. Magdalena Wekenborg and Prof. Dr. Corinna Peifer with assistance of Kirsten Handschuch. Fabienne Aust drafted the manuscript. Dr. Magdalena Wekenborg, Prof. Dr. Corinna Peifer, Kirsten Handschuch, Nicole Rothe, Andreas Walther, Marlene Penz and Julian Eder provided critical revision.

Abstract

The experience of flow in the workplace – a rewarding state of complete absorption during the execution of an optimal challenging task – has been studied frequently in previous research. In particular, due to its positive effects on performance and well-being, it represents a construct that is attracting increased attention in the context of Positive Psychology research. In the context of this dissertation, flow experience is considered in relation to two aspects of the working environment which are relevant for many employees: teamwork and symptoms of burnout. The aim of this dissertation is to gain in-depth insights regarding the experience of flow in teams and to investigate the associations of stressors and resources of teamwork with team flow. In addition, the relationship between burnout symptoms and flow is to be examined in more detail, thereby taking potential underlying mechanisms into account. The new insights are used to extend the Transactional Model of Stress and Flow (Peifer & Tan, 2021).

Three studies were conducted as part of this dissertation. In Study I the potential influencing factors on the experience of team flow were investigated. An online questionnaire study was conducted with firefighters to capture whether the experience of stressors and resources that occur during teamwork have an influence on team flow. It was found that the more frequently stressors occurred in firefighting missions (e.g., no clear leadership structures, lack of shared mental models), the less frequently team flow was experienced. Resources (e.g., unambiguous, and clear communication, supportive behaviors) were associated with more frequent team flow. In short, the results of Study I imply that stressors cause situations to be perceived as unmanageable and stress to be experienced instead of team flow. Resources, on the other hand, could enhance coping and contribute to interpreting the situation as a challenge, which in turn is conducive to team flow.

In Study II, a systematic review was used to provide an overview of previous empirical findings on the relationship between burnout symptoms and flow. As part of this study, the Flow-Burnout-Model was developed, which describes different explanations for the relationship between the two constructs. Physiological aspects were also taken into account (e.g., physiological activation during flow and stress, chronic stress). Overall, the review showed that most studies find a negative association between burnout

symptoms and flow. This suggests that fewer burnout symptoms are associated with increased flow. Study III was designed to replicate these relationships. The negative associations between burnout symptoms and flow were also found, both cross-sectionally and longitudinally. However, no associations were found between flow and physiological markers of chronic stress considered in this study (hair cortisol concentration, heart rate variability). This suggests that the subjective stress experience, rather than chronic stress markers, may be a mechanism for the association between burnout symptoms and flow.

Both aspects of teamwork and burnout symptoms were integrated into the Transactional Model of Stress and Flow in this dissertation. On the one hand, team flow was added as a potential outcome of the transactional appraisal process, and the various stressors and resources of teamwork were included as influencing factors in this process. On the other hand, burnout symptoms were integrated as long-term consequences reciprocally related to flow based on the mainly negative associations found between these constructs in the systematic review and in our own empirical study.

With the help of this dissertation, new insights regarding the experience of flow in today's working world were gained and a theoretically based model was expanded. In this context, very specific influencing factors were identified with regard to team flow, which underpin the prerequisites for team flow described in research to date with concrete behaviors. It was shown that stressors and resources that occur during teamwork are linked to the experience of team flow. These findings can be used to derive specific interventions for strengthening team flow. In this context, Crew Resource Management approaches might be useful. Moreover, findings on the consequences of flow were expanded. Numerous studies demonstrate the link with components of well-being. In the context of this dissertation, associations with burnout symptoms were now systematically investigated. The predominantly negative correlations found between burnout symptoms and flow can be seen as a rational for interventions to strengthen flow and reduce burnout symptoms. For example, interventions to reduce negative interpretation patterns could be implemented to counteract burnout symptoms and enhance flow.

In this dissertation, some limitations have to be considered. It should be noted that in flow and team flow research as well as in research on burnout symptoms, no uniform standards have yet been found in

the definition and measurement. All three constructs have so far been assessed primarily by self-reports, with a variety of questionnaires existing, some of which focus on different aspects of the constructs. Uniform measurement methods and the additional use of more objective markers (e.g., physiological activation, observations) would be desirable. Also, with regard to the study design, experimental and longitudinal studies should be conducted in the future in order to consider different directions of effect more explicitly.

Future research can derive further hypotheses on the interrelationship of the different constructs from the extended model and expand the model if necessary. In doing so, further aspects of the modern working world, such as artificial intelligence, can also be considered. For practice, implications can be derived regarding the development of training to strengthen teamwork and reduce burnout symptoms.

German Abstract

Das Erleben von Flow am Arbeitsplatz, welches einen Zustand der vollständigen Absorbiertheit beim Ausführen einer optimal beanspruchenden Aufgabe beschreibt, wurde in der bisherigen Forschung schon häufig untersucht. Insbesondere durch die positiven Effekte auf die Leistung und das Wohlbefinden stellt es ein Konstrukt dar, welches im Rahmen der positiv-psychologischen Forschung vermehrt Aufmerksamkeit erregt. Im Rahmen dieser Dissertation wird das Flow-Erleben im Zusammenhang mit zwei Aspekten der Arbeitswelt betrachtet, die für viele Arbeitnehmende relevant sind: Teamarbeit und Burnout Symptome. Ziel dieser Dissertation ist es, vertiefte Erkenntnisse über das Erleben von Flow in Teams zu gewinnen und die Zusammenhänge von Stressoren und Ressourcen der Teamarbeit mit Teamflow zu untersuchen. Darüber hinaus soll der Zusammenhang zwischen Burnout Symptomen und Flow detaillierter betrachtet werden, wobei mögliche zugrunde liegende Mechanismen berücksichtigt werden. Die neuen Erkenntnisse werden genutzt, um das Transaktionale Modell von Stress und Flow (Peifer & Tan, 2021) zu erweitern.

Im Rahmen dieser Dissertation wurden drei Studien durchgeführt. In Studie I wurden die möglichen Einflussfaktoren auf das Erleben von Teamflow untersucht. Es wurde eine Online-Fragebogenstudie mit Einsatzkräften der Feuerwehr durchgeführt, um zu erfassen, ob das Erleben von Stressoren und Ressourcen, die während der Teamarbeit auftreten, einen Einfluss auf den Teamflow haben. Es zeigte sich, dass je häufiger Stressoren in den Brandschutzeinsätzen auftraten (z.B., keine eindeutigen Führungsstrukturen, fehlende geteilte mentale Modelle), desto seltener wurde Teamflow erlebt. Ressourcen (z.B., eindeutige und klare Kommunikation, unterstützendes Verhalten) gingen mit häufigerem Teamflow einher. Insgesamt deuten die Ergebnisse der Studie I darauf hin, dass Stressoren dazu führen, dass Situationen als unbeherrschbar wahrgenommen werden und Stress anstelle von Teamflow erlebt wird. Ressourcen hingegen könnten bei der Bewältigung der Situation unterstützen und zu einer Interpretation als Herausforderung beitragen, was wiederum für das Teamflow-Erleben förderlich ist.

In Studie II wurde anhand eines systematischen Reviews ein Überblick über bisherige empirische Befunde zum Zusammenhang zwischen Burnout Symptomen und Flow gegeben. In diesem Zuge wurde das Flow-Burnout-Modell entwickelt, das verschiedene Erklärungsansätze für die Beziehung zwischen den beiden Konstrukten beschreibt. Dabei werden auch physiologische Aspekte berücksichtigt (physiologische Erregung während Stress und Flow, chronischer Stress). Insgesamt zeigte das Review, dass die meisten Studien einen negativen Zusammenhang zwischen Burnout Symptomen und Flow finden. Das spricht dafür, dass weniger Burnout Symptome mit einem vermehrten Flow-Erleben einhergehen. In Studie III sollten diese Zusammenhänge repliziert werden. Die negativen Assoziationen wurden auch in unserer empirischen Studie gefunden, sowohl quer- als auch längsschnittlich. Allerdings zeigten sich keine Zusammenhänge zwischen Flow und physiologischen Markern von chronischem Stress, die in dieser Studie berücksichtigt wurden (Haarcortisol, Herzratenvariabilität). Dies könnte darauf hindeuten, dass das subjektive Stresserleben ein Mechanismus für den Zusammenhang zwischen Flow und Burnout Symptomen darstellen könnte und nicht die chronischen Stressmarker.

Sowohl das Teamflow-Erleben als auch die Burnout Symptome wurden im Rahmen dieser Dissertation in das Transaktionale Modell von Stress und Flow integriert. Dabei wurde zum einen das Teamflow-Erleben als mögliches Ergebnis des transaktionalen Bewertungsprozesses ergänzt und die verschiedenen Stressoren und Ressourcen der Teamarbeit wurden als beeinflussende Faktoren in diesem Prozess einbezogen. Zum anderen wurden die Burnout Symptome als langfristige Konsequenzen integriert, die reziprok mit dem Erleben von Flow zusammenhängen. Dies geschah aufgrund der überwiegend negativen Assoziationen, die zwischen diesen Konstrukten in dem systematischen Review und in unserer eigenen empirischen Studie gefunden wurden.

Mit Hilfe dieser Dissertation wurden neue Erkenntnisse über das Flow-Erleben in der heutigen Arbeitswelt gewonnen und ein theoretisch fundiertes Modell erweitert. Dabei wurden sehr spezifische Einflussfaktoren auf den Teamflow identifiziert, welche die in der bisherigen Forschung beschriebenen Voraussetzungen für Teamflow mit konkreten Verhaltensweisen untermauern. Es konnte gezeigt werden, dass Stressoren und Ressourcen, die während der Teamarbeit auftreten, mit dem Erleben von Teamflow verbunden sind. Aus diesen Erkenntnissen lassen sich spezifische Interventionen zur

Stärkung des Teamflows ableiten. In diesem Zusammenhang könnten Ansätze des Crew Resource Managements sinnvoll sein. Darüber hinaus wurden die Erkenntnisse zu den Konsequenzen von Flow erweitert. Zahlreiche Studien belegen den Zusammenhang mit Komponenten des Wohlbefindens. Im Rahmen dieser Dissertation wurden nun systematisch Zusammenhänge mit Burnout Symptomen untersucht. Die gefundenen, überwiegend negativen Korrelationen zwischen Burnout Symptomen und Flow können als Begründung für Interventionen zur Stärkung des Flow und zur Reduktion von Burnout Symptomen gesehen werden. So könnten beispielsweise Interventionen zur Reduzierung negativer Interpretationsmuster durchgeführt werden, um Burnout Symptomen entgegenzuwirken und Flow zu verstärken.

Im Rahmen der Dissertation müssen einige Limitationen berücksichtigt werden. Es ist anzumerken, dass sowohl in der Flow- und Teamflow-Forschung als auch in der Forschung zu Burnout Symptomen noch keine einheitlichen Standards in der Definition und Erhebung gefunden wurden. Alle drei Konstrukte werden bisher vor allem durch Selbstberichte erfasst, wobei es eine Vielzahl von Fragebögen gibt, die sich teilweise auf unterschiedliche Aspekte der Konstrukte konzentrieren. Wünschenswert wären einheitliche Messmethoden und der zusätzliche Einsatz von objektiveren Markern (z.B. physiologische Aktivierung, Beobachtungen). Auch hinsichtlich des Studiendesigns sollten in Zukunft experimentelle und längsschnittliche Studien durchgeführt werden, um unterschiedliche Wirkrichtungen expliziter zu berücksichtigen.

Zukünftige Forschung kann aus dem erweiterten Modell weitere Hypothesen über die Zusammenhänge der verschiedenen Konstrukte ableiten und das Modell gegebenenfalls erweitern. Dabei können auch weitere Aspekte der modernen Arbeitswelt, wie z.B. die künstliche Intelligenz, berücksichtigt werden. Für die Praxis lassen sich Implikationen für die Entwicklung von Trainings zur Stärkung der Teamarbeit und zur Reduzierung von Burnout Symptomen ableiten.

1 General Introduction

In today's world, experiencing stress is commonplace for many individuals. According to a global survey by the Gallup World Poll, 44% of respondents had experienced a lot of stress the previous day. This number reflects a new peak for people's stress experiences that have been reported to date (Gallup Inc., 2022). The same trend can be observed in Germany as stress-levels increased over the past years (Techniker Krankenkasse, 2021). Work is one of the main contributors to stress in Germany, which is also reflected in the fact that the stress experienced is only reduced significantly when working life ends (Techniker Krankenkasse, 2021). Stress at work is associated with several negative outcomes for employees and employers, such as dissatisfaction, cardiovascular disease, substance use or absenteeism (for an overview see Beehr & Newman, 1978 and Beehr, 2014). Dealing with stress-relevant situations at work in the right way can help relieve stress and reduce its negative consequences (e.g., Lazarus & Folkman, 1984). As people spend a lot of their lifetime at work, it seems reasonable to design the work environment in such a way that employees experience less stress and more enjoyment. It can be assumed that a more suitable working environment can reduce one of the main sources of stress in employees' lives.

Approaches to this are offered, for example, by *Positive Psychology*. This is a branch of psychology that deals with building up and strengthening resources (Seligman & Csíkszentmihályi, 2000). A concept that is investigated in this context is, among many others, flow experience. Flow is a rewarding state in which individuals are fully absorbed in an activity and the demands of the task are in balance with the skills of the person (Csíkszentmihályi, 1975). It is more often experienced in the context of work than during leisure (Csíkszentmihályi & LeFevre, 1989; Schallberger & Pfister, 2001) and is associated with enhanced performance and well-being (e.g., Bassi et al., 2014; Christandl et al., 2018; Demerouti, 2006; Rijavec et al., 2017). Due to the positive consequences, creating flow-promoting working conditions seems to be reasonable and could be an approach to reduce stress at work.

A model that explains the emergence of flow is the *Transactional Model of Stress and Flow* by Peifer and Tan (2021). In the model, potentially stress-relevant situations are considered and different ways of

dealing with them are described. Within several appraisal steps it is evaluated whether an individual has enough resources to cope with the demands of a situation. While stress is experienced when individuals do not have sufficient resources to cope with a situation perceived as a threat or harm, flow is experienced when a situation is seen as a challenge and there are sufficient resources to cope with it. These coping resources are then focused on the task execution. The model can be applied well in the work context. At work, individuals encounter potentially stressful situations repeatedly. To reduce the experience of stress and promote the experience of flow, both the handling of demands at work as well as individual and organizational resources can be influenced (for an overview see Peifer & Wolters, 2021). Thus, the Transactional Model of Stress and Flow provides a theoretical basis for the development of various flow-promoting interventions at work.

In the scope of this dissertation, the overarching aim is to extend this model regarding two aspects that are relevant in today's working environment: teamwork and burnout symptoms. To this purpose, these constructs and the relationships with flow are examined in more detail.

First, it will be described how aspects of teamwork can be considered in the Transactional Model of Stress and Flow. Considering that a lot of people work in teams as well as the positive consequences of team flow on performance (e.g., van den Hout et al., 2019), it is desirable to investigate the processes involved in the emergence of team flow in more detail. Van den Hout et al. (2018) described prerequisites and characteristics of team flow and summarized the findings in a conceptual model. The study within the scope of this dissertation will explicitly consider stressors and resources occurring during teamwork and empirically investigate their relationship with team flow.

Second, the associations with burnout symptoms will be examined. Burnout symptoms are defined as consequences of chronic work stress (Maslach et al., 2001). The prevalence of burnout symptoms is on a high level and increasing (Rotenstein et al., 2018; Shanafelt et al., 2015) implicating negative consequences for employees and organizations. This includes for example an impaired life satisfaction (Hakanen & Schaufeli, 2012), decreased performance (Demerouti et al., 2014) and cardiovascular diseases (Melamed et al., 2006). Some studies already showed negative associations between burnout symptoms and flow (e.g., Demerouti et al., 2012; Mosing et al., 2018), indicating that more flow could

come along with fewer burnout symptoms. Nevertheless, research in this area is scarce, so a more detailed investigation of associations between burnout symptoms and flow, including the description of a theoretical basis and the investigation of possible underlying mechanisms, seems useful and is provided in this dissertation.

By integrating these two aspects into the Transactional Model of Stress and Flow, this dissertation is enhancing our understanding of flow and considers current topics from the work context. This can help to better understand phenomena from people's working life and to find mechanisms in the development of (team) flow and burnout symptoms. From this, interventions can be derived that can contribute to strengthening flow and team flow as well as to reducing burnout symptoms. This can support stress relief in the workplace as well as the reduction of stress-related negative consequences.

2 Theoretical Background

In this chapter, the key constructs considered in this dissertation are introduced and the underlying research questions are derived. In this course, the flow concept is first described in more detail and relevant factors are presented. An emphasis is placed on the Transactional Model of Stress and Flow (Peifer & Tan, 2021), the extension of which is the overarching aim of the dissertation. Previous research regarding team flow is discussed. In addition, the burnout concept is defined and possible relationships with flow are considered.

2.1 Flow

The concept of flow was first described by Mihalyi Csíkszentmihályi in 1975. He interviewed different individuals – like rock climbers, dancers or chess masters – to investigate why they are pursuing an activity without external reward. He described flow as a rewarding state in which individuals are challenged in an optimal way and can fully concentrate on an activity at hand. They have control over the process and know exactly what to do during task execution. In this process, individuals are completely absorbed by the task and feel that actions happen as if by themselves (Csíkszentmihályi, 1975, 1990).

2.1.1 Core Flow Components

Flow research grew and over the years more and more researchers dealt with the experience of flow. Accordingly, the initial definition was gradually expanded. Recent work of Peifer and Engeser (2021) postulates three core components of flow, namely: (1) absorption, (2) perceived demand-skill balance and (3) enjoyment. These were derived from various empirical and theoretical findings and include several components of flow, which are briefly described below:

(1) Absorption: The flow components *merging of action and awareness*, *centering of attention* and *loss of self-consciousness*, which were already described by Csíkszentmihályi in 1975, can be assigned to the core component absorption (Peifer & Engeser, 2021). During the flow experience, full concentration is completely directed to the task and distracting cues such as evaluative thoughts or external stimuli are

faded out. Individuals feel that all actions performed serve the successful execution of the current task. This creates the feeling of action-self merging (Peifer & Engeser, 2021). Another aspect of this core component is the *distortion of temporal experience of time*. This describes the feeling that time passes quickly during task processing.

(2) Perceived demand-skill balance: Regarding the perceived fit of demands and skills, Csíkszentmihályi (1975) already postulated within the Flow Channel Model, that flow is experienced when there is a balance between action opportunities (here: *demands*) and action capabilities (here: *skills*). In contrast, boredom and anxiety come along with under- and overchallenge (Csíkszentmihályi, 1975). These assumptions regarding the balance between demands and skills as important aspects for the emergence of flow were specified in the further course of research. For example, the quadrant model of flow (Csíkszentmihályi & Csíkszentmihályi, 1988) states that flow is only experienced when demands and skills are balanced at a high level. However, when this balance is at a low level of demands, apathy may result. But these assumptions are controversial and further research is needed to understand the exact relationships. For example, Barthelmäs and Keller (2021) assume if the subjective value of a task is high, flow can still be experienced even during trivial tasks. Moreover, Baumann et al. (2016) described the concept of a dynamic balance and found that phases with slightly-above average demands in combination with regular breaks can be conducive to flow.

In general, however, the balance of demands and skills is central to the experience of flow. Thus, some experimental studies attempt to induce flow states by creating optimally demanding tasks or to inhibit flow using inappropriately demanding tasks (e.g., Keller et al., 2011; Kozhevnikov et al., 2018; Tozman et al., 2017). In other words, balance is actively manipulated to induce boredom, flow, or anxiety. For example, a study by Keller et al. (2011) examined the influence of difficulty level in a knowledge test. It was found that subjects in a fit condition and where task difficulty was matched to ability, experienced the highest involvement. Involvement was thereby described as an important component of flow. In the boredom and overload conditions, the values of involvement were lower.

The manipulation of the demand-skill balance as a way of creating flow, however, also highlights a point that remains to be discussed in the context of flow research. Some researchers assume that this

balance is a precondition for experiencing flow (Barthelmäs & Keller, 2021). Others describe the perceived demand-skill balance as a component of the flow experience (Peifer & Engeser, 2021). In this regard, Peifer and Engeser (2021) postulate that there are several aspects that can be manipulated to create flow-promoting conditions (e.g., setting clear goals, enabling feedback), but the *subjective* experience of these can be considered a component of flow. Accordingly, they refer to the perceived balance of demands and skills as a core component. In some cases, this distinction between the precondition or the component is not entirely sharp. In the context of this dissertation the perceived demand-skill balance is seen as a core component of flow following the definition of Peifer and Engeser (2021).

Additionally, they include aspects like *feelings of control*, *experience of coherent, non-contradictory demands*, *experience of clear goals* and *experience of unambiguous feedback* to the core component perceived demand-skill balance as they can all contribute to the experience of balance (Peifer & Engeser, 2021)

(3) Enjoyment: The enjoyment facet is described with the aspects *autotelic nature*, *intrinsic motivation* and *enjoyment* (Peifer & Engeser, 2021). In this context, autotelic nature is already described by Csíkszentmihályi (1975) as a component of the flow experience. Bakker (2005) in particular then describes intrinsic motivation as another aspect highly related to flow. Abuhamdeh (2021) deals extensively with the discourse of whether flow experience involves the feeling of enjoyment or not. He contrasts the views of Csíkszentmihályi and Seligman. While Csíkszentmihályi (1975) was convinced that flow is a special form of enjoyment, Seligman held that no emotions are experienced in flow (Seligman, 2002). Abuhamdeh (2021) postulates that emotions can indeed be experienced during flow and accordingly concludes that flow is a form of enjoyment. Peifer and Engeser (2021) agree with these assumptions and define enjoyment as a core component of flow. I concur with this definition in the context of this dissertation.

In sum, in the course of this dissertation I refer to the definition of Peifer and Engeser (2021) who define flow as “the enjoyable experience of full absorption in an activity in which the demands are perceived as optimally compatible with one’s skills” (Peifer & Engeser, 2021, p. 424).

2.1.2 Flow at Work

Already in the early stages of flow research, it became apparent that flow occurs quite frequently in the context of work (Csíkszentmihályi & LeFevre, 1989). These associations have also been found in other research (Fullagar & Kelloway, 2009; Schallberger & Pfister, 2001). In a study by Csíkszentmihályi and LeFevre (1989), employees from different work fields were asked when they experienced situations characterized with high demands and high skills. It was found that these states, which are typical of flow, occurred more frequently at work. The consequences of flow on performance and well-being were often investigated in a labor context as well (for an overview see Llorens & Salanova, 2017; Demerouti, 2006; Rivkin et al., 2018) underlining the high relevance of the flow research in the work context.

An overview of different antecedents and consequences of flow especially relevant in the work context is given by Peifer and Wolters (2021). They categorize the antecedents and consequences of flow at work into three spheres: individual sphere, job/task sphere, and organizational/social sphere. Bakker and van Woerkom (2017) postulate that flow at work may be related to self-determination and present several strategies that can be used to fulfill basic needs and enhance flow experience. These include, for example, job crafting or designing playful working conditions. At the personal and organizational level, there are factors that can moderate the relationship between self-determination strategies and flow (Bakker & van Woerkom, 2017). These aspects can also be classified in the framework by Peifer and Wolters (2021).

2.1.2.1 Antecedents of Flow at Work

In order to create flow-promoting conditions at work, the three spheres framework by Peifer and Wolters (2021) offers various starting points. In the following, some research results and assumptions regarding the antecedents are presented.

In the individual sphere, for example, personality can be considered as an influencing factor. It was found that flow proneness is positively associated with conscientiousness and negatively with neuroticism (Ullén et al., 2012). A study in the work context showed that only for highly conscientious employees flow at work predicted performance (Demerouti, 2006). In a recent study, the moderating

effect of the locus of control on the relationship between feedback and flow was investigated (Hohnemann et al., 2022). Individuals with an internal locus of control assume that they have control over events and that changes in the situation are dependent on their own behavior (Rotter, 1966). Negative feedback was found to have a negative effect on flow only for individuals with an internal locus of control, but not for individuals with an external locus of control (Hohnemann et al., 2022). Another personal-level aspect associated with the experience of flow is the sense of humor (Bartzik, Aust, & Peifer, 2021). During the COVID-19 pandemic, it was shown that a higher sense of humor can buffer the negative effects on flow at work for nurses. Moreover, self-efficacy can be considered a facilitating factor for flow. In an experimental setting with a student sample, it was shown that positive feedback can increase self-efficacy, which leads to more flow in a subsequent task (Peifer, Schönfeld, et al., 2020). A longitudinal study of teachers also showed the positive effects of work-related self-efficacy on flow (Rodríguez-Sánchez, Salanova, et al., 2011). The psychological capital (PsyCap) including hope, efficacy, resilience, and optimism (Luthans et al., 2004) can also be classified as an antecedent in the individual sphere and was found to be positively associated with flow (Kawalya et al., 2019; Zubair & Kamal, 2015b). Furthermore, Bakker and van Woerkom (2017) postulated that using one's strengths can positively influence flow. These assumptions have also been confirmed empirically as strength use in the previous hour (e.g., using own talents at work) was associated with increased flow (Liu et al., 2022).

In the organizational/social sphere, there are different organizational resources that can enhance flow at work (e.g., Bakker, 2005; Salanova et al., 2006). In a longitudinal study by Salanova et al. (2006) it was shown that if individuals perceive various organizational resources (i.e., social support, innovation orientation, rules orientation and goal orientation) they experience flow at work more often. Reflecting the importance of social support, for instance, a recent study found a negative relationship between loneliness and flow (Taser et al., 2022). The relationship between organizational resources and flow appears to be bidirectional indicating that more flow also leads to the building of more resources at work (Salanova et al., 2006). In addition, collective efficacy beliefs are also found to be positively related to flow at work. High collective efficacy beliefs lead to more collective flow, which in turn has positive

effects on collective efficacy indicating an upward spiral (Salanova et al., 2014). Various studies have also examined the influence of leadership styles on flow experience. Transformational leadership was found to be positively related to flow, and this relationship was mediated by empowerment (Schermuly & Meyer, 2020). Authentic leadership and servant leadership are also positively related to flow (Khan et al., 2021; Zubair & Kamal, 2015a). There is also a positive association between a high quality leader-member exchange and flow (Aydin Kucuk, 2022). Another organizational resource that can promote flow experience is the creation of adequate conditions in remote e-work. Thus, individuals with positive experiences in remote e-work (e.g., feelings of effectiveness) had more flow than individuals who assess e-work more negatively (Taser et al., 2022).

The job/task sphere includes aspects from the *Job Characteristics Model* of Hackman and Oldham (1975). The core job dimensions skill variety, task identity, task significance, autonomy and feedback were investigated in several studies with regard to the relationship with flow. Thereby, Maeran and Cangiano (2013) found that task significance and feedback from the job predicted flow at work. Demerouti (2006) used a *Motivating Potential Score* that included all five core dimensions and found a positive relationship with flow. Furthermore, an intervention study showed that clear goals, which were already mentioned by Csíkszentmihályi (1975) as an antecedent for flow, have an influence on the flow experience. It was found that people who received nudges on the topic of goal setting experienced more flow (Weintraub et al., 2021). Another aspect that could influence the flow experience is short periods of rest during task execution. In an experimental study it was found that a dynamic balance of demands and skills, including short rest periods, can positively influence flow (Baumann et al., 2016). In addition, so-called challenge stressors (e.g., time pressure) can have a positive effect on flow. However, when hindrance stressors (e.g., role conflicts) occur, the positive influence of challenge stressors on flow decreases (van Oortmerssen et al., 2020). The learning value at work also has a positive impact on flow (van der Heijden & Bakker, 2011).

2.1.2.2 Consequences of Flow at Work

The consequences of flow at work have been examined in numerous studies. Positive consequences were often found in the various spheres, especially regarding well-being and performance. In the

following section, some research results and assumptions about the consequences are presented. Additionally, potential negative consequences are also described, which, however, have been investigated to a lesser extent so far.

Findings regarding increased performance, well-being and self-efficacy can be classified as consequences in the individual sphere (Peifer & Wolters, 2021). These consequences are especially relevant in the context of work and have been studied thoroughly, therefore they are presented in more detail.

Different studies report that flow is associated with various components of well-being. For example, Rivkin et al. (2018) examined the extent to which the experience of flow mediates the positive relationship between affective commitment and various indicators of well-being within the framework of a diary study. They referred to the flow core component absorption and measured well-being in the form of ego-depletion, need for recovery, work engagement and subjective vitality. They found that the positive association between affective commitment and well-being was mediated by flow experience. Flow was significantly related to all four indicators of well-being (negative: ego depletion, need for recovery, positive: work engagement and subjective vitality). A study by Peifer, Syrek, et al. (2020) also examined flow as a mediator in a sample of employees. They found that the experience of flow mediates the negative relationship between unfinished tasks and well-being. More precisely, individuals with multiple unfinished tasks experienced less flow in leisure, which resulted in lower well-being compared to individuals with fewer unfinished tasks. Further studies show for example positive associations of flow with indicators of hedonic and eudemonic well-being among adolescents (Bassi et al., 2014), energy after work (Demerouti et al., 2012) and positive affect among students (Rogatko, 2009). Flow was also studied as a factor in well-being during the COVID-19 pandemic. It was found that adolescents who experienced flow reported higher positive affect and lower negative affect than those who reported no flow experiences (Bassi et al., 2022). In another study, flow was further examined as a potential coping mechanism and found to be negatively associated with depression, loneliness, and unhealthy behaviors, while it was positively related to positive emotions (Sweeny et al., 2020). In addition, flow

acted as a moderator with respect to the effects of quarantine length on several parameters of well-being (Sweeny et al., 2020).

With regard to performance, many studies – in the laboratory as well as in the field – show a positive relationship to flow experience (e.g., Christandl et al., 2018; Demerouti, 2006; Engeser & Rheinberg, 2008). Barthelmäs and Keller (2021) postulate that, on the one hand, flow may have a direct effect on performance as it is a highly functional state with increased concentration and a heightened sense of control. On the other hand, flow could lead to increased motivation (Engeser & Rheinberg, 2008) and thus indirectly affect performance. Flow experience was shown to be positively associated with increased in-role and extra-role performance (Bakker, 2008; Demerouti, 2006) and subjectively rated work performance (Peifer & Zipp, 2019). Moreover, self-assessed performance in terms of innovations is positively related to flow in high-technological turbulence environments (Slavec Gomezel & Aleksić, 2020). In the context of sports and gaming tasks, positive associations with performance are also found (for an overview see Harris et al., 2021). Besides, flow is positively associated with various forms of commitment (Rivkin et al., 2018; M. B. Smith et al., 2012), which in turn may have positive effects on subjective performance (Bartzik et al., 2020). In an experimental study by Christandl et al. (2018), the positive associations between perceived flow and performance were shown to transfer to a follow-up task. Participants who had subjectively experienced more flow in the first task (by manipulating the perception of time) showed improved performance in a follow-up task. Although the study by Christandl et al. (2018) provide evidence that flow has an effect on performance, a reciprocal effect should be discussed as well. Thus, Barthelmäs and Keller (2021) propose increased performance also leading to subjectively experiencing more flow.

Self-efficacy was already mentioned as an antecedent of flow. Since there is empirical evidence that the relationship between flow and self-efficacy is reciprocal, indicating that self-efficacy positively predicts flow, and the experience of flow also leads to more self-efficacy, self-efficacy can also be seen as a consequence of flow (Salanova et al., 2006).

Regarding the organizational/social sphere, Peifer and Wolters (2021) assume that a climate can be created in which more flow can be experienced. In a study among music teachers and their students it

was found that flow is contagious – the more often the teacher experienced flow during teaching the more often the students reported this experience when playing music (Bakker, 2005). In another study it was found that the perception of other people's flow is positively associated with one's own flow experience (Culbertson et al., 2015). Moreover, the reciprocal association between collective flow and collective efficacy beliefs (Salanova et al., 2014) could be included in the organizational/social sphere.

Concerning the task sphere, the building of resources is closely related to the experience of flow (Mäkikangas et al., 2010; Salanova et al., 2006). This could enhance job crafting and new structuring of tasks (Peifer & Wolters, 2021). In addition, individuals experiencing more intense flow were found to be more open to new work methods (Tausch & Peifer, 2019).

Already Csíkszentmihályi pointed out in 1990 that "Flow experience, like everything else, is not good in an absolute sense" (p. 70). This shows that in addition to the positive consequences of flow described above, there are potentially negative aspects associated with flow. However, while the positive consequences of flow have received much attention in recent years, less is known about the negative consequences. Zimanyi and Schüler (2021) provide an overview of the potential negative consequences highlighting the potential risk of addiction, the underestimation of risk, and the possibility to experience flow in antisocial contexts. Since the potential risk of addiction is of particular relevance in the context of this dissertation, it will be discussed in more detail below.

The risk of addiction could be categorized in the individual sphere. It is described that the positive experiences during flow can act as rewards in the concept of operant conditioning. This can lead to the need to perform the activities repeatedly, resulting in behavioral addiction (Zimanyi & Schüler, 2021). The symptoms of behavioral addiction, such as the desire to repeat the behavior, performing the activity despite potential negative effects on health and social relationships, or performing the behavior longer and more intensely than necessary, are similar to the symptoms of addictions and pathological gambling (Grüsser et al., 2007; Hausenblas & Downs, 2002). In the context of sport, Partington et al. (2009) conducted interviews with big wave surfers. The surfers reported components of flow they felt while surfing, but also mentioned negative consequences, such as withdrawal symptoms during periods of non-surfing, neglect of other areas of life, or the development of tolerance. Relationships to flow have

also been found in other contexts, such as problematic internet use (H.-K. Kim & Davis, 2009; Thatcher et al., 2008) or cyber-gaming (Chou & Ting, 2003). Overall, in previous research, little attention has been paid to behavioral addiction as a potential consequence of flow. However, since possible negative consequences could also be relevant in the work context, for example in the form of workaholism as an "inner pressures that make the person feel distressed or guilty about not working" (Spence & Robbins, 1992, p. 161) this should be considered more closely.

Taken together, studying flow in the context of work is highly relevant. On the one hand, the numerous positive consequences suggest that flow at work should be strengthened. Influencing factors should be studied further to be able to derive possible interventions to increase flow. On the other hand, the potential hazards should not be ignored.

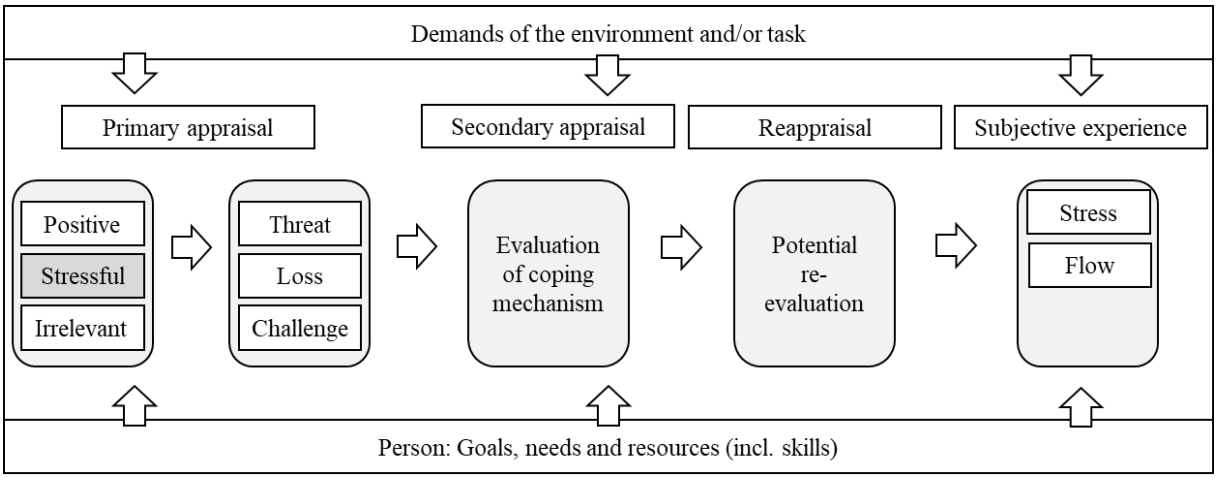
That is why this dissertation focuses on the experience of flow at work and especially on two aspects of work which are highly relevant in today's working world: teamwork and the experience of burnout symptoms. In this context, this dissertation contributes to the examination of further factors that may influence the experience of flow and to the investigation of possible long-term consequences. The two aspects – teamwork and burnout symptoms – will be integrated into the existing Transactional Model of Stress and Flow which is explained in detail below.

2.1.3 Transactional Model of Stress and Flow

A model that focuses on the emergence of flow is the Transactional Model of Stress and Flow (see Figure 2.1). The model is an extension of the Transactional Stress Model of Lazarus and Folkman (1984). In the Transactional Model of Stress and Flow, it is described that stress or flow can be experienced throughout different cognitive appraisal steps in a potentially stressful situation (Peifer & Tan, 2021). When a potentially stressful situation occurs, it is first examined whether the situation is seen as a threat, loss, or challenge. The next appraisal step then considers whether there are sufficient coping resources to handle the demands of the situation. While stress occurs when the situation is interpreted as a threat or loss and there are not enough resources to cope with the situation, flow can occur when a situation is perceived as a challenge and there are enough resources to cope with the

situation (Peifer & Tan, 2021). Both assessment steps can be constantly revisited in reappraisal (Lazarus & Folkman, 1984; Peifer, 2012; Peifer & Tan, 2021).

Figure 2.1 *Transactional Model of Stress and Flow (adapted from Peifer and Tan, 2021)*



The previously described antecedents of flow at work can also be categorized in this model. In this context, the task can be understood as the concrete work assignment, such as the preparation of a presentation. If this task is perceived as challenging, and if there are sufficient resources, such as appropriate skills and self-efficacy, flow can occur at work. This shows that the Transactional Model of Stress and Flow is very well suited to explain the emergence of flow at work.

In the context of this dissertation, this model will now be extended to include the aspects of teamwork and burnout symptoms as potential long-term consequences – two major aspects in the context of work. Thus, on the one hand specific stressors and resources that occur because of teamwork and, on the other hand, burnout symptoms which could be associated with flow in the long-term are integrated in the model. In the following sections, team flow (Chapter 2.2) and burnout symptoms (Chapter 2.3) are defined, and previous research findings are presented. Thereby, the research questions are derived, which are to be answered in the context of this dissertation.

2.2 Team Flow

In the last years the experience of flow within teams raised more and more attention. As employees work more often in teams and first evidence shows that flow in teams is associated with enhanced performance (Aubé et al., 2014; Heyne et al., 2011; van den Hout et al., 2019), it seems reasonable to

consider the experience of flow at work within teams in more detail (e.g., van den Hout & Davis, 2019). To do so, the next section gives an overview about the different terms used in this context and outlines different components of team flow. Thereby, the association between stressors and resources of teamwork and team flow will be discussed in particular and the research questions will be presented.

2.2.1 Definition and Conceptualization

Various terms are used for the phenomenon of flow at group level, such as social flow (Walker, 2010, 2021), collective flow (Quinn, 2005), group flow (Sawyer, 2017) or team flow (van den Hout et al., 2018). In the scope of this dissertation, I refer to the term *team flow* which is also used by van den Hout et al. (2018). This is because in the working context, as addressed in this dissertation, the term team is more common (see Pels & Kleinert, 2022). Van den Hout et al. (2018) define team flow as "a shared experience of flow during the execution of interdependent personal tasks in the interest of the team, originating from an optimized team dynamic" (p. 415).

Based on the different descriptions in previous research, Peifer et al. (2021) derived four meta-categories of team flow characteristics. These include (1) communication and feedback, (2) shared goal commitment, (3) equal participation, and (4) trust in others' knowledge, skills and attitudes. They emphasize that team flow shares common characteristics with individual flow but has additional characteristics that are unique to team flow. The various meta-categories of team flow are briefly described below:

(1) Communication and feedback: Open communication is described by van den Hout et al. (2018) as a requirement for team flow. Thereby, timely and unambiguous feedback between team members plays a central role. Close listening is also considered important in communication and feedback (Sawyer, 2017; van den Hout et al., 2018).

(2) Shared goal commitment: In the various approaches to experiencing flow at the group level, the focus on a common goal is emphasized consistently. In this context, van den Hout et al. (2018) describe that, on the one hand, there must be a common goal in the team that is clear and meaningful to all team members. On the other hand, the individual goals of the team members must be consistent with the team

goal. Walker (2010) also postulates that agreement regarding the goal can promote joint flow. In addition, Quinn (2005) describes that the feeling of moving toward a common goal is a component of the shared flow experience.

(3) Equal participation: Another aspect of team flow is the equal participation. Sawyer (2017) emphasizes that flow can occur in the group when all participants can equally participate in the achievement of the goal. He also describes that group members should have similar levels of ability. Van den Hout et al. (2018) mention that the utilization of the complementary skills of team members at a high skill level is a prerequisite for team flow. It is also important that the team members know each other's strengths to be able to assign the tasks according to their abilities (van den Hout et al., 2018).

(4) Trust in others' knowledge, skills and attitudes: Sawyer (2017) describes that flow in the group becomes more likely when team members are aware of each other’s behaviors and there is shared knowledge. Mutual trust is also described by van den Hout et al. (2018) as a component of team flow. Among other things, this trust is characterized by the willingness to be vulnerable and team effectiveness. Also, van den Hout et al. (2018) cite safety as a prerequisite for team flow. This sense of safety could also be associated with trust in team members.

With regard to the assessment of team flow, there have been various approaches to date (for an overview see Pels et al., 2018). Some studies have aggregated individually experienced flow at the team level and used this as an indicator of flow in the team (Aubé et al., 2014; Heyne et al., 2011). Van den Hout et al. (2019), however, developed an instrument that considers team flow as a shared phenomenon and surveys directly the perception in the team. They consider the prerequisites and characteristics of team flow and use nearly 40 items to capture the construct. It was found that team flow measured with the *Team Flow Monitor* was positively associated with performance, happiness and personal flow (van den Hout et al., 2019).

In this dissertation, for economic and content-based reasons, a self-developed scale with 12 items was used for the assessment of team flow. Items were constructed considering the perception of flow in the team following the approach of van den Hout et al. (2019). Aspects of individual flow (Rheinberg et al.,

2003) and additional aspects of team flow (van den Hout et al., 2019) were taken into account, as both are experienced during team flow as described above.

2.2.2 Stressors and Resources of Teamwork associated with Team Flow

Overall, it appears that processes that take place at the group level (e.g., communication, participation) are considered prerequisites or characteristics of team flow in the various descriptions of the phenomenon. Thus, the demands created by teamwork (e.g., needs for communication and coordination) could be considered in the Transactional Model of Stress and Flow as further demands of the environment or task. In this context, demands initially denote the neutral description of the situation with the associated task in a specific environment. Thereby, reference can be made to Rheinberg and Engeser (2018), who describe demands as an objective level of difficulty referring to the example of climbing routes by Csíkszentmihályi (1975). Here, the difficulty level, which has not yet been set in relation to the person's abilities, can initially be regarded as neutral. Bakker and Demerouti (2007) also describe that job demands are not negative in principle but can turn into stressors if coping with these demands involves high efforts from which one cannot sufficiently recover (see also Meijman & Mulder, 1998). Thus, neutral demands of teamwork could be integrated in the model.

In addition to the demands, stressors and resources of teamwork are also considered. Stressors in teamwork can be viewed as stimuli arising because of teamwork that require continuous effort (de Jonge & Dormann, 2006). In this context, the occurrence of work-related stressors can be seen as causal to the stress process (Beehr, 2014). Teamwork resources can be considered as job resources in the work context. These can be described as coping options (de Jonge & Dormann, 2006) and thus as factors that support in coping with the demands. In the context of this dissertation, teamwork stressors and resources were explicitly surveyed that triggered stress or that assisted in coping. Thereby, for example, improper communication or a lack of a common goal could prevent a situation from being judged as manageable, since teamwork stressors must be managed in addition to task demands. Good communication or clear role assignment, on the contrary, are mentioned as resources that could ensure that a balance of demands and coping skills is perceived. These aspects could be integrated in the Transactional Model of Stress and Flow.

However, besides the theoretical derivations regarding the requirements and components of team flow and the possible influences of teamwork processes on the experience of team flow, there are few empirical studies so far that examine these influences in more detail. To narrow this gap, we conducted an empirical study with firefighters. This sample is suitable for generating basic insights regarding team flow, as teamwork is a very high priority in firefighting missions and many interdependent tasks, that are necessary for the experience of team flow (see definition of van den Hout et al., 2018), occur within a mission. In addition, firefighting missions are very dynamic and offer a variety of factors in teamwork (e.g., Hagemann et al., 2011) that could potentially influence the experience of team flow. This provides good starting points to fundamentally survey influencing factors regarding team flow, which is one aim of this dissertation. Nevertheless, transferability to other contexts seems possible, since although specific stressors and resources typical for the firefighting context were surveyed at the item level, the superordinate categories (e.g., communication, leadership) can also be applied in other contexts. Adjustments in the survey of stressors and resources would then need to be made.

As there are still some open questions regarding the emergence and experience of team flow, in the course of this dissertation, the research gap shall be narrowed by answering the following research questions:

Research Question 1: What relationships exist between stressors and resources of teamwork and the experience of team flow?

Research Question 2: How can the theoretical assumptions about the emergence of team flow be integrated into the Transactional Model of Stress and Flow considering empirical findings?

2.3 Burnout Symptoms

Due to the increase in chronic stress at work in recent years (Gallup Inc., 2022; Techniker Krankenkasse, 2021), the psychological construct of burnout has increasingly come into focus. Some studies have already found a negative association between burnout symptoms and flow (e.g., Demerouti et al., 2012; Mosing et al., 2018) but the overall empirical evidence is scarce. Therefore, one aim of this dissertation is to investigate this relationship in more detail and to integrate it into the Transactional Model of Stress

and Flow. In the next section the construct of burnout will be defined, and current pitfalls are addressed. Moreover, the associations with flow are described and research questions are presented.

2.3.1 Definition and Conceptualization

The phenomenon burnout is described as an affective reaction to chronic work stress, which is characterized by the three core components of emotional exhaustion, reduced personal accomplishment, and cynicism (Maslach & Leiter, 2016; Maslach et al., 2001). Based on these descriptions, the burnout syndrome is classified as an occupational phenomenon in the International Classification of Diseases 11 (ICD-11) and defined as "a syndrome conceptualized as resulting from chronic workplace stress that has not been successfully managed" (World Health Organization, 2020). Despite the inclusion in the ICD-11, there is still a need for clarification regarding the assessment of burnout symptoms and the distinction from other related constructs in research, which will be briefly outlined.

The most widely used survey instrument – referred to as gold standard (e.g., Schaufeli et al., 2020) – is the *Maslach Burnout Inventory* (MBI) by Maslach and Jackson (1981). There are various occupational-specific versions of the MBI, like the MBI-Educators Survey (MBI-ES; Maslach & Jackson, 1986) or the MBI-Student Survey (MBI-SS; Schaufeli, Martínez, et al., 2002). Moreover, the MBI-General Survey (MBI-GS; Schaufeli et al., 1996) was established which assesses the burnout concept in a more general context. The MBI assumes a three-dimensional construct with the sub-dimensions emotional exhaustion, reduced personal accomplishment and depersonalization (Maslach & Jackson, 1981, 1986; Schaufeli et al., 1996). Kalimo et al. (2003) developed an indicator of a burnout syndrome that weights the three sub-dimensions differently and combines them into an overall score. Other conceptualizations adopt two-dimensional approaches (e.g., *Oldenburg Burnout Inventory [OLBI]*; Demerouti et al., 2003) or focus entirely on exhaustion as the core element (e.g., *Copenhagen Burnout Inventory [CBI]*; Kristensen et al., 2005). However, this focus could lead to a simplification of the burnout syndrome and leave important aspects of the syndrome unconsidered (Maslach & Leiter, 2016). The newly developed *Burnout Assessment Tool* (BAT; Schaufeli et al., 2020) assumes seven dimensions. Four of which are recorded as core dimensions (exhaustion, cognitive and emotional impairment, mental distance) and load on the second-order factor "burnout". Three dimensions are referred to as secondary dimensions

(depressed mood, psychological distress, psychosomatic complaints). These different conceptualizations of the burnout syndrome show that there is still a need for research in the theory of burnout syndrome and that no final definition and survey standards have been found yet.

Due to its leading role in the field, its empirical validation and the applicability to a broad target group, in this dissertation the MBI-GS is used to capture burnout symptoms and therefore assumes a three-dimensional construct. The sub-dimensions are considered individually and the total score according to Kalimo et al. (2003) is used as well.

One aspect that should always be considered in connection with burnout symptoms is the closeness to the construct depression. The distinction between burnout symptoms and depression is still controversial. For example, some researchers assume that the two constructs overlap strongly and cannot be considered distinctly (Bianchi et al., 2015) or suggest that the burnout syndrome can be described as depressive symptoms at work (Ahola et al., 2014). A reciprocal relationship has also been shown such that burnout predicted depression and vice versa (Ahola & Hakanen, 2007). However, a meta-analysis from 2019 concluded that burnout and depression are two distinct and robust constructs (Koutsimani et al., 2019). The burnout syndrome is also considered distinct from depression for the purposes of this dissertation. However, the high correlation between the two constructs is accounted for by controlling for the presence of depression in the analyses.

2.3.2 Burnout Symptoms and Flow

Burnout symptoms are associated with numerous negative consequences at the personal and organizational level. For example, associations have been found with decreased job performance (Demerouti et al., 2014), reduced life satisfaction (Hakanen & Schaufeli, 2012), impaired health (Melamed et al., 2006), and psychological problems (Ahola & Hakanen, 2007; Dyrbye et al., 2008).

Since flow can be seen as an alternative subjective experience to stress when a potentially stressful situation is perceived as challenging (Peifer & Tan, 2021), flow could be understood as a buffer against burnout symptoms, since acute stress and thus in the long run chronic stress can be reduced. However, there could also be a risk of addiction (Zimanyi & Schüler, 2021), which could promote burnout

symptoms. The relationship between burnout symptoms and flow, however, has rarely been addressed. Several studies have shown that burnout symptoms and flow are negatively related. These associations have been found in cross-sectional studies (e.g., Lavigne et al., 2012; Ljubin-Golub et al., 2020) as well as in longitudinal designs (e.g., Demerouti et al., 2012; Mäkikangas et al., 2010). However, other studies also describe positive associations between burnout symptoms and flow (Kasa & Hassan, 2016) or between emotional exhaustion and absorption as a facet of flow (Baumgarten et al., 2020). Moreover, no significant associations were found in some cases (e.g., Kasa & Hassan, 2015; Martínez-Zaragoza et al., 2014). Consideration of different facets of flow and sub-dimensions of burnout and different empirical methods may have led to the different results. Furthermore, there has also been little investigation of potential underlying processes.

Overall, it appears that the theoretical foundation of the relationship between burnout symptoms and flow has not yet been sufficiently discussed. Potential negative and positive associations should be evaluated both on a theoretical level and previous research results should be classified. In this course it is worthwhile to generate a systematic overview of existing literature regarding the association between burnout symptoms and flow. Moreover, these findings should be investigated empirically in more depth. In the context of this dissertation, these research gaps should be addressed by means of the following research questions:

Research Question 3: What empirical relationships have been found between burnout symptoms and the experience of flow so far?

Research Question 4: To what extent can the cross-sectional and longitudinal associations already found between burnout symptoms and flow be replicated?

Research Question 5: How can the theoretical assumptions on the relationship between burnout symptoms and flow be integrated into the Transactional Model of Stress and Flow considering empirical findings?

One potential underlying mechanism that may explain the association between burnout symptoms and flow could be the experience of stress and the physiological response to it. Burnout symptoms as well

as flow are closely associated with stress (e.g., Maslach et al., 2001; Peifer et al., 2014), so it seems feasible that stress could (partially) influence the relationship between burnout symptoms and flow.

In this course the physiological stress reaction should be considered in more detail. Thereby, the two main stress-related psychophysiological systems play a decisive role – the hypothalamus-pituitary-adrenal (HPA) axis and the autonomic nervous system (ANS) with its two branches (i.e., the sympathetic [SNS] and parasympathetic nervous system [PNS]). While activation of the HPA axis is indicated by an increase in cortisol levels (Foley & Kirschbaum, 2010), activation of the ANS can be reflected by parameters of vagally-mediated heart rate variability (vmHRV; Thayer et al., 2012). In particular, parasympathetic activation is used because it can modulate heart rate in the range of milliseconds (Berntson et al., 1997; Kuo et al., 2005; Saul, 1990) and it can be assumed that high-frequency (HF) changes in heart rate variability (HRV) can be considered a relatively pure signal for vagal function (see Wekenborg, Schwerdtfeger, Rothe, et al., 2022). In this context, the Root Mean Square of Successive Differences (RMSSD) can be used as a marker on the time domain, and HF can be used on the frequency domain (Laborde et al., 2017). Regarding the markers for chronic stress, which are examined in this dissertation, hair cortisol concentration (HCC) and hair cortisone concentration (HCN) can be used as markers for the activation of the HPA axis. Briefly, cortisol released in an acute stressful situation is stored long-term in the hair. Natural hair growth can be used to retrospectively determine accumulated cortisol levels, where hair grows approximately 1 cm per month, thus one cm of hair represents the accumulated cortisol level for one month (E. Russell et al., 2012; Stalder et al., 2017). Activation of the ANS can be represented by vmHRV markers that have been collected in a resting state (e.g., RMSSD, HF). In this state, vmHRV can be understood as a relatively stable trait-like marker (Bertsch et al., 2012).

In previous research, flow has been considered in the context of both subjective stress experience and physiological stress markers. However, to the best of our knowledge, markers for the acute stress response have been increasingly used and no markers of chronic stress (for an overview see Khoshnoud et al., 2020 and Peifer et al., 2022). Thereby, flow is considered a state between relaxation and stress (Peifer et al., 2014; Peifer & Tan, 2021), which also shows great overlap with the concept of eustress, described by Selye (1983) as a pleasant state of stress characterized by fulfillment. At the physiological

level, flow is associated with acute moderate physiological arousal (e.g., Chin & Kales, 2019; Peifer et al., 2014; Tozman et al., 2017). Burnout symptoms are also associated with both subjective stress perception and physiological arousal. On the one hand, burnout symptoms are described as a consequence of chronic stress at work (World Health Organization, 2020), which describes the prolonged stress triggered by continuous or recurring stressors (Baum et al., 1999). These stressors are often found in the context of work (Baum et al., 1999) and on the other hand, it has been shown that burnout symptoms are associated with increased subjective perceptions of stress (Wekenborg et al., 2019). Moreover, evidence has also been found at the physiological level that various markers of chronic stress, such as an elevated HCC and resting vmHRV, are associated with or even predict burnout symptoms (Penz et al., 2018; Wekenborg, Schwerdtfeger, Rothe, et al., 2022).

The close links of flow and burnout symptoms with physiological and psychological stress could represent an underlying mechanism. Thus, reappraising a situation and interpreting it as a challenge rather than a threat could ensure that flow is experienced instead of acute stress, which could be associated with lower physiological arousal. In the long run, accumulated psychological and physiological stress could thus become lower, making burnout symptoms less likely. In contrast, the risk of addiction to flow (see Chapter 2.1.2) should not be ignored. The rewarding nature of the flow experience could lead to repeatedly seeking out situations in which flow is experienced (Zimanyi & Schüler, 2021) and comes along with a steady moderate physiological activation (e.g., Peifer et al., 2014). In the context of work, this could lead to workaholism, the inner pressure to have to work (Spence & Robbins, 1992). In the long run, without appropriate recovery, the steady physiological activation could become a burden and promote burnout symptoms.

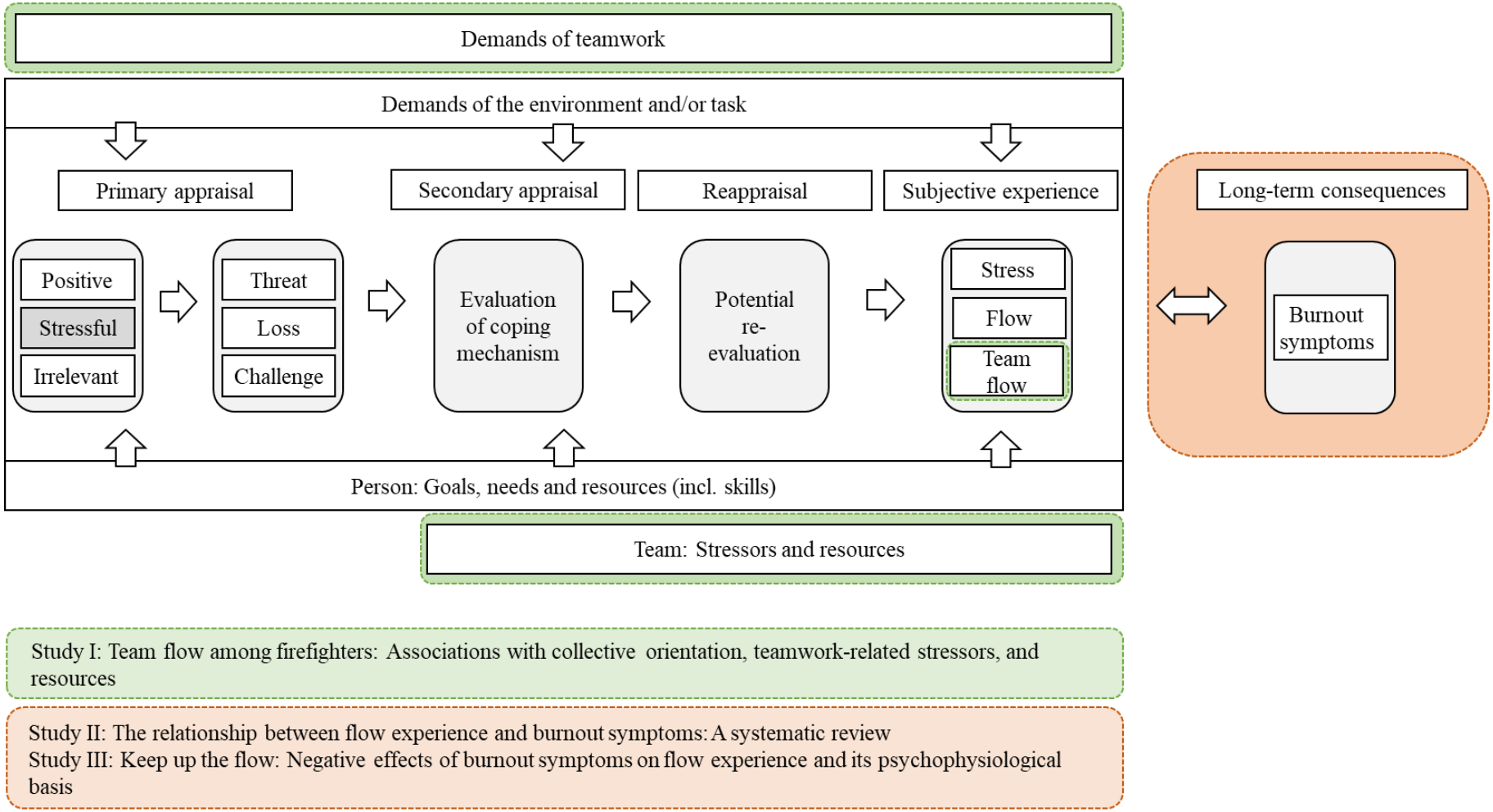
Therefore, another aim of the dissertation is to examine the previous empirical findings in more detail, and to investigate the theoretically derived potential underlying mechanisms with regard to stress. This is done to answer the following research question:

Research Question 6: What associations does flow show with physiological markers of chronic stress that are related to burnout symptoms?

3 Aims of the Dissertation

In the scope of this dissertation, new insights into the experience of flow at work are to be gained. On the one hand, it will be considered to what extent stressors and resources of teamwork can have an influence on the experience of team flow. On the other hand, the relationship between burnout symptoms and flow will be investigated, taking into account different potential underlying mechanisms. As an overarching research aim the Transactional Model of Stress and Flow is to be extended by including (1) aspects of teamwork and (2) the association with burnout symptoms as long-term consequences. These extensions could help to get a more comprehensive picture of the flow experience and to provide new approaches to create an attractive working environment that is conducive to well-being and performance not ignoring potential risks. In Figure 3.1, the different planned extensions are shown in the Transactional Model of Stress and Flow. The green marked fields indicate the first extension regarding the aspects of teamwork and the orange marked fields indicate the second extension regarding the burnout symptoms. In addition, an overview is given of which study within this dissertation deals with the respective extensions.

Figure 3.1 *Research Program for this dissertation: Extension of the Transactional Model of Stress and Flow (adapted from Peifer & Tan, 2021)*



The aim of Study I is to answer research questions 1 and 2 and thereby include aspects of teamwork into the model. Within the study "*Team flow among firefighters: Associations with collective orientation, teamwork-related stressors, and resources" (Aust, Heinemann, et al., 2023)*, it was tested if the experience of stressors and resources of teamwork during firefighting missions is associated with the experience of team flow. In order to reach the mission objectives, additional demands on team members such as communication and coordination needs were hypothesized. On the one hand, stressors of teamwork (e.g., inadequate communication, leadership problems) might hinder the experience of the perceived demand-skill balance and lead to less team flow. On the other hand, the work with team members could help to cope with the demands. Resources of teamwork, e.g., precise information, supporting behavior or good leadership, could help to perceive a demand-skill balance that is typical for flow and team flow. Empirical evidence for these assumptions is presented within Study I.

The aim of Study II and Study III is to generate deeper insights into the relationship between burnout symptoms and flow and to identify possible patterns of effect. Based on this, burnout symptoms as possible long-term consequences of flow should be integrated into the Transactional Model of Stress and Flow (research questions 3, 4 and 5). It is well known that flow is associated with well-being (Bassi et al., 2014; Rivkin et al., 2018), but research regarding the association with burnout symptoms is unsystematic and scarce. Therefore, a systematic literature review with the title *"The relationship between flow experience and burnout symptoms: A systematic review" (Aust et al., 2022)* was carried out to get an overview and to derive a theoretical model about the relationships between burnout symptoms and flow and its potential underlying mechanisms (Study II). In a second step, some of the proposed associations were empirically tested in the study *"Keep up the flow: Investigating the relationship between burnout symptoms and flow experience and its psychophysiological basis" (Aust, Peifer et al., 2023).* As such, cross-sectional as well as longitudinal associations between burnout symptoms and flow were investigated with the help of a questionnaire study. Furthermore, it was checked if flow is associated with physiological markers of chronic stress that are known to be associated with burnout symptoms and could present an underlying mechanism (Study III), thereby answering research question 6.

4 Study I: Team Flow Among Firefighters: Associations with Collective Orientation, Teamwork-Related Stressors, and Resources

Reference: **Aust, F.,** Heinemann, L., Holtz, M., Hagemann, V., & Peifer, C. (2023). Team Flow Among Firefighters: Associations with Collective Orientation, Teamwork-Related Stressors, and Resources. *International Journal of Applied Positive Psychology, 8*(2), 339–363. https://doi.org/10.1007/s41042-023-00093-7

Only minor formatting changes have been made, e.g., to the font, tables, citation style, presentation of statistics, or figures, in order to achieve a consistent formatting style throughout this thesis.

4.1 Abstract

Flow is often experienced under stress-related conditions and associated with improved performance and well-being. Different workplace stressors and resources demonstrably affect individual flow. Considering the team level, our study explores the associations between typical teamwork-related stressors and resources and team flow. Firefighters work under extremely challenging conditions and rely on functioning teamwork processes, thereby constituting a promising sample for examining team flow and its associated factors. An online questionnaire was implemented in Germany examining frequency of team flow, experienced teamwork-related stressors, and resources in firefighting missions. Collective orientation was also measured as a factor potentially associated with team flow. The final sample consisted of 317 experienced firefighters. Multiple regression analyses showed that the more often firefighters experienced stressors of teamwork (e.g., problems regarding leadership or lacking shared mental models) the less often they experienced team flow. Conversely, the experience of resources of teamwork (e.g., good communication and shared mental models) was associated with more frequent team flow. Collective orientation was positively associated with team flow. As team competencies are trainable, the study offers concrete approaches for interventions strengthening teamwork and team flow, thereby benefitting firefighters but also teams in other professions.

Keywords: Team flow; Firefighting; Collective Orientation; Teamwork

4.2 Introduction

A second-floor apartment is on fire. Cries for help can be heard. Passers-by alert the fire department. Within minutes firefighters arrive. The situation is hectic and stressful, but the firefighters stay calm. Interdependent tasks are allocated. Clear orders are given, and professionals cooperate. Within minutes, all in the building are rescued and the fire is extinguished.

Such an ideal mission cannot be taken for granted. Many different processes must be coordinated to ensure a good result.

Firefighters are part of so-called High Responsibility Teams (HRTs; Hagemann et al., 2012), working interdependently and under high pressure, handling demanding situations without interruptions, termination, or correction of these. Firefighters bear major responsibility for people's health and safety (Hagemann et al., 2011, 2012), hence they do stressful and onerous work.

Flow is a frequently experienced state in stress-relevant situations (e.g., Rheinberg & Manig, 2003; Weimar, 2005) and demonstrable associated with problem-focused coping (Pinquart & Silbereisen, 2010). Flow can be defined as a state in which individuals feel fully absorbed in a challenging task (Csíkszentmihályi, 1975) and is associated with improved performance (Christandl et al., 2018; Demerouti, 2006; Engeser & Rheinberg, 2008; Rijavec et al., 2017) and well-being (Rijavec et al., 2017; Rivkin et al., 2018). Due to its positive consequences, understanding which factors during work strengthen or hinder flow is vital. Interest is rising in transferring the concept of flow to the team level (van den Hout & Davis, 2019). Team flow has been described as a shared experience of flow within a team occurring while working on interdependent personal tasks (van den Hout & Davis, 2019). As described above, teamwork among firefighters occurs in stressful and dynamic environments and interdependent tasks must be accomplished quickly and efficiently. Firefighters thus serve well to investigate team flow and to identify factors related to team flow. This may therefore help to enhance future team performance among firefighters as flow in teams is associated with better team performance (Aubé et al., 2014; Heyne et al., 2011; van den Hout et al., 2019). While various workplace stressors and resources reportedly affect flow experience on an individual level in different ways (for an overview

see Peifer & Wolters, 2021), research on team flow remains scarce and heterogeneous (Peifer et al., 2021). This study aims to reduce this research gap by investigating the associations of team flow with typical teamwork-related stressors and resources in firefighting missions. By examining this particular sample, in which teamwork is a very high priority, we aim to identify starting points for examining associated factors of team flow in more detail, with a view to a later expansion to other contexts.

An attitude known to be significant in successful teamwork is collective orientation (Driskell et al., 2010; Hagemann & Kluge, 2017; Kilcullen et al., 2023). Defined as the "propensity to work in a collective manner in team settings" (Driskell et al., 2010, p. 317), it is amenable to experience and training. As people with a high collective orientation pay more attention to their team members and show better coordination processes (Hagemann et al., 2021; Salas et al., 2008), we further aim to investigate if collective orientation is associated with the experience of team flow.

4.2.1 Team Flow

For clarity, we use the term team flow here, although other terms, such as social flow (Walker, 2010), group flow (Sawyer, 2017) or collective flow (Quinn, 2005) occur. Even if these phenomena are not identical, they have a solid common basis (van den Hout et al., 2018) and conditions and characteristics of team flow can be derived (Peifer et al., 2021). Team flow is defined as "a shared experience of flow during the execution of interdependent personal tasks in the interest of the team, originating from an optimized team dynamic" (van den Hout & Davis, 2019, p. 28). Besides the characteristics of individual flow – absorption, perceived demand-skill balance, and enjoyment (Peifer & Engeser, 2021) – that are also part of team flow, team flow includes additional characteristics and has additional conditions based on the social nature of the construct and the special demands of teamwork (Peifer et al., 2021; Pels et al., 2018; van den Hout et al., 2018). The four meta-categories derived from the analysis of various descriptions of team flow characteristics and conditions by Peifer et al. (2021) are: communication and feedback, shared goal commitment, equal participation, and trust in each other's knowledge, skills, and attitudes.

Team flow is associated with better team performance. For example, van den Hout et al. (2019) found a positive relationship between team flow prerequisites and team performance. Moreover, Heyne et al.

(2011) found a positive relationship between flow aggregated at the team level and performance in complex planning tasks. Similar results were reported by Aubé et al. (2014) in project managing tasks. Despite the different survey methods, similar results emerged. Due to the positive effects of flow in teams on team performance it is worthwhile to investigate conducive and inhibiting factors of team flow, especially in the field of firefighting, where poor performance could have far-reaching consequences. Van den Hout and Davis (2022) collected data from workers describing why they experienced team flow and what prevented them from doing so. In our study, we want to apply these generally collected results more specifically to the context of firefighting.

A cooperative firefighting mission entails various task demands. Tasks necessitating management by firefighters throughout a mission include, securing the fire sight, setting up the water supply or rescuing victims. Although *taskwork* refers to work content (Marks et al., 2001), *teamwork* is indispensable (Salas et al., 2008). Hence a team, defined as "a set of two or more individuals who interact interdependently and adaptively toward a common goal or objective" (Cannon-Bowers & Salas, 1998, p. 83) performs certain processes together. These team processes are characterized as "members' interdependent acts that convert inputs to outcomes through cognitive, verbal, and behavioral activities directed toward organizing taskwork to achieve collective goals" (Marks et al., 2001, p. 357).

Well-functioning processes within the team perceived as good by the team members, are among the characteristics of team flow (Peifer et al., 2021). Sawyer (2017) describes the conditions of group flow with different facets of well-functioning teamwork, e.g., close listening to one another or constant and spontaneous communication. Successful coordination of activities, a collective goal (Quinn, 2005), and agreement about roles and procedures (Walker, 2010) are additional conditions of team flow (Peifer et al., 2021) that are also mentioned as components of process dimensions in the taxonomy of team processes (Marks et al., 2001). Accordingly, well-functioning team processes seem to be important for team flow. Van den Hout et al. (2018) additionally mention sense of unity, sense of joint progress, mutual trust, and a holistic focus as characteristics of team flow. In spite of a variety of descriptions for the characteristics and conditions of team flow, these conditions and characteristics of team flow as a whole exceed those of individual flow (Peifer et al., 2021). Accordingly, stressors and resources possibly

arising in teamwork should be scrutinized more closely as potentially inhibiting or reinforcing team flow.

4.2.2 Stressors and Resources of Teamwork Among Firefighters

Individuals in their work face different work-relevant stressors described as "the degree to which the work environment contains stimuli that require sustained cognitive, emotional, or physical effort" (de Jonge & Dormann, 2006, p. 1359). On the other hand, job resources can be referred to as options for coping (de Jonge & Dormann, 2006).

Heinemann et al. (2023) investigated the specific stressors and resources relevant in the field of firefighting. They conducted expert interviews and analyzed accident reports to identify different stressors and resources of teamwork in firefighting missions. Six core categories were identified representing different relevant aspects of teamwork in firefighting: communication, supporting behavior, leadership, shared mental models, organization/coordination, and decision-making. In each of these categories, team member behaviors are described that can be interpreted as stressors or resources of teamwork. For example, possible stressors appearing in firefighting missions are delayed disclosure of information (communication), not pointing out errors of team members (supporting behavior), hectic and uncertain behavior of leaders (leadership), lacking information on the approach and objective of the mission (shared mental model), failure to meet safety standards (organization/coordination) or no clear decision-making processes (decision-making). On the other hand, potential resources within this context are timely transfer of information (communication), checking on each other (supporting behavior), structured and calm leaders (leadership), knowing mission tactics (shared mental models), adherence to standards and safety measures (organization/coordination) or clearly defined decision structures (decision-making) (Heinemann et al., 2023).

The specific stressors and resources of teamwork for firefighters described by Heinemann et al. (2023) can be integrated in a well-known framework of teamwork processes by Marks et al. (2001). They argue that different team processes occur at different points of the task execution, distinguishing between the *action phase* (e.g., coordination and monitoring) and the *transition phase* (e.g., evaluation of performance and planning). There are moreover *interpersonal processes* (e.g., conflict and affect

management) influencing team performance. The stressors and resources relevant in firefighting missions can be attributed to all three process dimensions. For example, passing on information or supporting behavior could be included in the action phase, while decision-making about the strategy belongs to the transaction phase. Marks et al. (2001) moreover emphasize that different processes are used simultaneously to manage multitasking. We therefore aim to investigate effects of teamwork-related stressors and resources in the firefighting mission on team flow.

4.2.3 Effects of Stressors and Resources on Team Flow

An approach to understand how stressors and resources could be related to team flow is the *Transactional Model of Stress and Flow* (Peifer, 2012; Peifer & Tan, 2021). Based on Lazarus and Folkman (1984) the model describes the transactional process possibly leading to stress or flow. According to the Transactional Model of Stress and Flow, influential factors are the demands of the environment, as well as the person's goals, needs, and resources. Stress evolves when an individual perceives a situation as a threat and the demands of the situation exceed the resources available to cope with it. On the other hand, in a situation perceived as a challenge and for a person with enough resources to cope with it flow can be experienced (Peifer, 2012; Peifer & Tan, 2021). Through reappraisal it is possible for a threat to become a challenge (Lazarus & Folkman, 1984).

This model can be applied to team flow. First, teamwork entails demands. In a firefighting mission, different aspects of teamwork (e.g., communication, coordination) are needed to achieve the mission objective. Second, teamwork entails resources which can help to cope with a stressing situation: If team members e.g., give timely adequate information and coordinate actions effectively, the team members feel able to effectively handle the demands of the environment and will more likely interpret the situation as a challenge than as a threat. This contributes to a perceived balance of skills and demands, a core component of team flow (Peifer et al., 2021). Accordingly, the team members are more likely to experience team flow than stress. Conversely in the absence of such teamwork resources or – even worse – if teamwork stressors appear (e.g., poor communication or confusing coordination), the demand-skill balance is reduced, and stress may occur.

Based on the reported literature, we propose that:

Hypothesis 1 *Frequency of perceived teamwork-related stressors is negatively associated with frequency of team flow in firefighting missions.*

Hypothesis 2 *Frequency of perceived teamwork-related resources is positively associated with frequency of team flow in firefighting missions.*

As an additional exploratory research question, we further aim to investigate which teamwork stressors and resources have an association with team flow and which do not. Since Heinemann et al. (2023) assigned the stressors and resources found in teamwork in firefighting missions to six subcategories, it seemed reasonable to examine the influence of these subcategories in addition to the overall occurrence of stressors and resources. Accordingly, we examine whether the subcategories *communication, supporting behavior, leadership, shared mental models, organization/ coordination and decision-making* are related to the team flow experience.

4.2.4 Collective Orientation

In addition to the situational conditions potentially associated with the team flow experience, whether personal attitudes are also related to team flow also merits examination. One attitude related to aspects that are partially described in the conceptual work on team flow is collective orientation (Driskell et al., 2010; Hagemann & Kluge, 2017; Peifer et al., 2021; van den Hout et al., 2019). It is defined as "the propensity to work in a collective manner in team settings" (Driskell et al., 2010, p. 317). The enjoyment of team membership is one core element of collective orientation. Moreover, highly collectively oriented people focus on the achievement of team goals, value the opinion of others, and are willing to cooperate. They prefer working in a team to working alone (Driskell et al., 2010; Hagemann, 2017) and teams with members with high collective orientation values demonstrate more effective coordination behavior, also in very complex situations (Hagemann & Kluge, 2017; Hagemann et al., 2021). We assume that collective orientation is positively associated to team flow: behavioral consequences of collective orientation are among the conditions and characteristics of team flow. Examples include having a

collective goal and successful coordination of activities (Quinn, 2005) or listening closely to one another (Sawyer, 2017).

Barthelmäs and Keller (2021) argue that subjective attachment to an activity is important to experience flow. People who like the activity they are involved in are more likely to have an intense flow experience. Regarding collective orientation, people with a high collective orientation should experience team flow during a teamwork activity more frequently and intensely because they are more closely attached to teamwork-related tasks. Conversely, people who enjoy working in a team less should experience team flow less frequently and intensely, being subjectively less attached to the task at hand. In line with that we propose that:

Hypothesis 3 *Collective orientation is positively associated with frequency of team flow in firefighting missions.*

4.3 Methods

4.3.1 Participants and Design

The sample was recruited Germany-wide via a nationwide mailing-list of the fire brigade in Cologne, distribution through the fire brigade country schools, through advertisement in a firefighter magazine, advertisement on the project homepage, social networks, and personal contacts. The questionnaire was online from January 18 through May 25, 2021. With 1,135 people accessing our questionnaire online, 755 attempted the questionnaire, 438 were excluded due to (1) early termination of the questionnaire and missing values on the study variables (n = 329), (2) insufficient firefighting experience (n = 9), or (3) illogical responses (n = 100).

The final sample consisted of 317 participants, 301 men and 16 women (= 5%), which is fairly representative of firefighters in Germany (approx. 10% of woman in the voluntary fire brigade and approx. 2% in the professional fire brigade; cf. Deutscher Feuerwehrverband e.V [DFV], n.d.). Mean age was 40.71 years (SD = 11.18), range 18–70 years and 65.3% worked in the voluntary fire brigade, 30.6% in the professional fire brigade, and 4.1% in other fire brigades. The participants had worked in

their profession for 21.54 years on average, minimum two years, maximum 49 years (*SD* = 11.09, *n* = 308).

4.3.2 Measures

Stressors of teamwork in firefighting missions were measured with the recently developed questionnaire by Heinemann et al. (2023) consisting of 26 stressors typical of the firefighting context. For each stressor there was a brief description of a situation in a firefighting mission in which the respective stressor appeared. Participants had to rate on a 5-point rating scale how often (1 = *never* to 5 = *always*) they had experienced the respective situations in past firefighting missions. The stressors belong to the six categories *communication* (COM, 6 items, e.g., 'The information passed on was incorrect, inaccurate and/or incomplete.'), *supporting behavior* (SUP, 6 items, e.g., 'Firefighters did not pay attention to each other (e.g., did not check on each other; did not point out mistakes and/or hazards to others; did not intervene even when hazards were identified)'), *leadership* (LS, 4 items, e.g., 'Potential hazards and/or operational standards were not considered by one or more leaders (e.g., no functioning respirator monitoring; inadequate scene reconnaissance).'), *shared mental models* (SMM, 3 items, e.g., 'Firefighters lacked information on the course of action and objective of the mission (e.g., sequence of steps; mission strategy).'), *organization/coordination* (O&C, 4 items, e.g., 'Tasks were not distributed at all or not evenly, so some firefighters had to do too many tasks at the same time (e.g., listening in on the radio, issuing materials, and monitoring breathing apparatus).') *and decision-making* (DM, 3 items, e.g., 'It was not clearly defined who had to make this decision and/or the decision was made by someone who did not have the necessary information/skills.'). Total score was calculated using the mean of the items. This reflects a value that summarizes the occurrence of all the stressors of teamwork. A confirmatory factor analysis (CFA) was used to check the theoretically derived structure with 26 items loading on six subcategories, yielding in turn the total score. Furthermore, relevant correlations (indicated by the modification indices) were integrated in the model. The model which proved robust to violation of the multivariate normal distribution assumption by using a robust estimator (MLM) had an acceptable fit (TLI: 0.92, RMSEA: .05, SRMR: .05) referring to the recommendations of Vandenberg and Lance (2000). Furthermore, internal consistency was checked. Cronbach's α for the total score was

.92. The subcategories had a Cronbach's α between .47 and .79 (see Table 4.1). As mentioned by Ziegler et al. (2014), low internal consistency is a common problem in short scales but does not necessarily mean that reliability is low. Since the items represent relevant aspects of each subconstruct we avoided excluding single items from subcategories. The model fits when subcategories with low reliability are included so they are used in the analysis.

Resources of teamwork during firefighting missions were also measured with the instrument developed by Heinemann et al. (2023). Using the same structure as for stressors, a total of 23 teamwork resources were assessed in terms of frequency of occurrence. Again the six subcategories were *communication* (COM, 6 items, e.g., 'Information was passed on in time and/or brief consultations took place.'), *supporting behavior* (SUP, 5 items, e.g., 'The firefighter was responsive to the other person's needs and attempted to provide support.'), *leadership* (LS, 4 items, e.g., 'One or more leaders behaved in a calm and level-headed, structured and/or supportive manner. This reduced stress and transferred to others.'), *shared mental models* (SMM, 3 items, e.g., 'The firefighters knew the tasks in the other functions well enough that they could assess what the other person just needed (e.g., information) and/or how their own actions affected the others.'), *organization/coordination* (O&C, 3 items, e.g., 'The firefighters recognized possible tasks, acted independently and, if necessary, coordinated work steps on their own initiative (e.g. information about their own course of action).') *and decision-making* (DM, 2 items, e.g., 'Firefighters used new information to reassess the situation and decided to change the plan if necessary.'). The model with the 23 items loading on the six subcategories yielding in turn the total score had negative variances in a CFA with a robust estimator (MLM). By excluding the subcategory decision-making these problems were resolved and the model had a good fit (TLI: 0.97, RMSEA: .03, SRMR: .05; relevant correlations [indicated by the modification indices] were integrated). As the subcategory decision-making had a very low reliability (Spearman-Brown coefficient: .24) and, as mentioned above, no single items should be excluded from a subcategory, it was decided to exclude both items from interferential statistics to analyze the data by using a good fitting model. In the other subcategories Cronbach's α ranged from .52 to .80. The total score representing the occurrence of

teamwork-related resources (not including decision-making) in firefighting missions in general had a Cronbach's α of .89.

Team flow was assessed with 12 self-constructed items inspired by the Flow-Short-Scale (Rheinberg et al., 2003) and the Team-Flow-Monitor (van den Hout et al., 2019). Assuming that team flow results from characteristics of the individual flow experience and contains additional components (Peifer et al., 2021), we decided to adapt the FKS used to measure the characteristics of individual flow experience to the team flow and to add items assessing the additional conditions and characteristics of team flow (see Appendix A, Table A4.1). Thus, the various items were supplemented by specifically eliciting experiences in the team. This means that the object of measurement was team flow, but it was measured using individual self-reports. Participants rated on a 6-point rating scale (1 = *never* to 6 = *[almost] always*) how often they experienced team flow in firefighting missions. One example item is 'We felt optimally challenged as a team'. A total score was used since the team flow experience represents an interplay of the different aspects and can only be assumed to be a team flow experience if they occur simultaneously. Cronbach's α was .93. The structure was checked with the help of a CFA with a robust estimator (MLM). The model fit is good (TLI: 0.97, RMSEA: .06, SRMR: .03) assuming that the 12 items load on the general factor of team flow and relevant correlations (indicated by the modification indices) were considered. The factor loadings of the CFAs can be found in the Appendix A – Table A4.2, Table A4.3 and Table A4.4).

Collective orientation was measured with the German-language version of the Collective Orientation Scale (Hagemann, 2017). The scale consists of 16 items (e.g., 'I like working with others') rated on a 5-point Likert scale from 1 = *totally disagree* to 5 = *totally agree*. Cronbach's α was .83.

Control variables. Age, years of experience of firefighting missions, and number of firefighting missions experienced were collected as control variables. The aim was to check whether experience of missions influenced the team flow experience. This assumption is based on the expertise effect (Rheinberg, 2006), according to which in complex activities, basic skills must first be automated before flow can be experienced. In the context of firefighting missons, this could mean that experienced firefighters experience more flow due to their expertise. In the study by van den Hout et al. (2019), age

was also included as a control variable with regard to team flow experience, so it seemed reasonable to also include it here. Furthermore, age is often associated with more experience potentially supporting the expertise effect.

Table 4.1 *Means, standard deviations, internal consistency and intercorrelations between study variables*

Variable	*n*	*Mean*	*SD*	1	2	3	4	5	5.1	5.2	5.3	5.4	5.5	5.6	6	6.1	6.2	6.3	6.4	6.5	6.6	7
1 Age	317	40.71	11.18	-																		
2 Years of Experience	308	21.54	11.09	.89**	-																	
3 Firefighting Missions	308	352.95	473.96	.29**	.36**	-																
4 Collective orientation	313	3.65	0.46	.13*	.06	.07	.83															
5 Stressors – Frequency	316	2.39	0.46	.15**	.22**	.19**	-.18**	.92														
5.1 Communication	315	2.43	0.55	.16**	.20**	.17**	-.11	.88**	.79													
5.2 Supporting behavior	316	2.21	0.52	.13*	.21**	.15**	-.20**	.85**	.69**	.77												
5.3 Leadership	316	2.56	0.64	.06	.14*	.09	-.15**	.80**	.60**	.59**	.70											
5.4 Shared Mental Models	314	2.30	0.61	.13*	.15**	.09	-.22**	.71**	.56**	.52**	.51**	.65										
5.5 Organization/Coordination	313	2.51	0.54	.06	.16**	.18**	-.14*	.82**	.66**	.63**	.61**	.53**	.69									
5.6 Decision-Making	316	2.33	0.58	.17**	.24**	.17**	-.06	.66**	.52**	.49**	.48**	.38**	.45**	.47								
6 Resources – Frequency	309	3.77	0.34	.04	-.00	.00	.17**	-.55**	-.46**	-.46**	-.49**	-.49**	-.46**	-.21**	.89							
6.1 Communication	307	3.77	0.43	.03	-.01	-.03	.08	-.54**	-.53**	-.42**	-.41**	-.41**	-.45**	-.26**	.84**	.80						
6.2 Supporting behavior	307	3.82	0.41	.05	.01	.06	.17**	-.38**	-.28**	-.41**	-.33**	-.32**	-.27**	-.15*	.79**	.53**	.68					
6.3 Leadership	312	3.64	0.43	-.00	-.03	-.03	.13*	-.41**	-.29**	-.31**	-.55**	-.34**	-.31**	-.17**	.71**	.47**	.51**	.52				
6.4 Shared Mental Models	310	3.92	0.46	-.04	-.05	-.03	.13*	-.45**	-.30**	-.36**	-.40**	-.64**	-.32**	-.20**	.67**	.49**	.47**	.47**	.63			
6.5 Organization/Coordination	308	3.70	0.43	.01	-.02	-.07	.11	-.44**	-.33**	-.37**	-.38**	-.35**	-.53**	-.14*	.67**	.48**	.40**	.43**	.40**	.52		
6.6 Decision-Making[1]	312	3.69	0.51	.02	-.00	.00	.14*	-.31**	-.22**	-.27**	-.27**	-.29**	-.24**	-.20**	.44**	.35**	.37**	.39**	.39**	.28**	.24[2]	
7 Team flow	311	4.64	0.65	.04	.01	.02	.15*	-.51**	-.36**	-.44**	-.45**	-.45**	-.43**	-.25**	.59**	.53**	.46**	.42**	.50**	.42**	.28**	.93

Note. Pairwise deletion was used. * $p < .050$, ** $p < .010$ (two-tailed). Internal consistency is indicated on the diagonal.
[1]This subcategory is not used for further analysis and the items are not included in the total score of the resources.
[2] Due to the limited number of items in the Resources - Decision-Making category (only two items), we used the Spearman-Brown coefficient as a measure of reliability instead of Cronbach's alpha.

4.3.3 Data Analysis

The robust CFAs (using the MLM estimator) were performed with the software program R and the package "Lavaan" (Rosseel, 2012). Data were analyzed with the IBM SPSS statistics package V28. First, we excluded outliers (> 2.5 *SD*) on the study variables (not for age and years of working experience). Therefore, *n* varies for the different analyses. Next, we checked with regressions if the control variables age, years of working experience and number of firefighting missions were associated with team flow. As the three control variables were highly correlated, we used three separate regressions to avoid problems with multicollinearity. Neither age ($F(1, 309) = 0.39$, $p = .535$), nor years of working experience ($F(1, 300) = 0.03$, $p = .866$) or number of firefighting missions ($F(1, 300) = 0.18$, $p = .674$) predicted team flow. Furthermore, the control variables were not correlated with team flow (see Table 4.1), so they were not considered in the later stages of the analysis.

To investigate Hypotheses 1 and 2 we computed a multiple regression. To explore which stressors or resources were associated with team flow we also used multiple regressions. Requirements for the analyses were met for the most part (outliers, linearity, multicollinearity, normal distribution). We used bootstrapping (5,000 samples) to control the results of the analysis as slight violations of the homoscedasticity assumption occurred and to generate more robust parameter estimators.

To investigate the relationship between collective orientation and team flow (Hypothesis 3) we calculated the regression coefficient.

A priori power analysis for the regression model was conducted using G*Power (Faul et al., 2009). Since to the best of our knowledge there are so far no studies examining the relationship of team flow with specific teamwork stressors and resources in the firefighting context, we assumed medium effect sizes. A power of .95 and a significance level of .050 were defined for all analyses. For the regression with two predictors and an assumed effect size of $f^2 = 0.15$, 107 participants were required. This requirement was met.

4.4 Results

4.4.1 Descriptive Results

Table 4.1 presents the means, standard deviations, internal consistencies and intercorrelations between the study variables.

In terms of collective orientation, the sample reaches a mean of 3.65 (*SD* = 0.46). This value is slightly above the mean values of past samples (e.g., Hagemann et al., 2021: *M* = 3.12 [0.46], *N* = 116). With regard to stressors and resources of teamwork, it can be seen that, on average, resources are perceived more frequently than stressors. This is true for the total score as well as for the subcategories. The correlations in Table 4.1 further show descriptively that stressors are negatively associated with team flow while the experience of resources is positively associated with team flow. Once again, this applies to the total scores as well as to the various subcategories.

4.4.2 Testing Hypotheses

To test Hypotheses 1 and 2 we investigated the relationship between the perceived teamwork stressors and resources and team flow. The linear model which regresses team flow on experience of stressors and resources was significant, $F(2, 304) = 100.03$, $p < .001$. R^2 for the model was .40 (adjusted R^2 = .39), which indicates a high goodness-of-fit according to (Cohen, 1988). Frequency of stressors as well as frequency of resources experienced in firefighting missions significantly predicted team flow, suggesting that the more often firefighters experience teamwork stressors in firefighting missions the less often they experienced team flow. Frequency of experiencing resources of teamwork was positively associated with frequency of team flow. An overview is given in Table 4.2. Regression with bootstrapping confirmed the results. Hypotheses 1 and 2 were supported by these findings.

Table 4.2 *Summary of multiple regression analyses on team flow with stressors and resources of teamwork as predictors (n = 307)*

Predictor	*b [CI]*	SE_b	β	*t*	*p* (p_{boot})
Stressors of teamwork	-0.36 [-0.51, -0.20]	0.08	-0.25	-4.73	< .001 (< .001)
Resources of teamwork	0.87 [0.66, 1.09]	0.11	0.46	8.65	< .001 (< .001)

Note. 95% confidence interval (CI) and standard error estimated by BCa-bootstrapping with 5,000 BCa-samples.

To explore which stressors and resources were related to team flow, we regressed team flow on the subcategories of the questionnaire of stressors and resources of teamwork in firefighting missions separately for teamwork stressors and resources. The decision-making subcategory of resources was not considered (see description of measures).

The stressor subcategories shared mental models, leadership, supporting behavior and organization/coordination significantly predicted less frequent team flow. The model explained $R^2 = .30$ (adjusted $R^2 = .28$) and was significant, $F(6, 298) = 21.10$, $p < .001$. Stressors in the subcategories communication and decision-making were not significant predictors of team flow. Table 4.3 gives an overview of the multiple regression analyses. The results of the regression were confirmed by the bootstrapping analyses.

Table 4.3 *Summary of multiple regression analyses on team flow with stressor subcategories of teamwork as predictors (n = 305)*

Predictor	*b [CI]*	SE_b	β	*t*	*p* (p_{boot})
Communication	0.09	0.09	0.08	1.00	.317 (.299)
	[-0.08, 0.27]				
Supporting behavior	-0.24	0.11	-0.19	-2.59	.010 (.031)
	[-0.45, -0.03]				
Leadership	-0.22	0.07	-0.21	-3.15	.002 (.004)
	[-0.36, -0.06]				
Shared Mental Models	-0.25	0.07	-0.23	-3.84	< .001 (< .001)
	[-0.38, -0.12]				
Organization/Coordination	-0.17	0.09	-0.14	-2.02	.044 (.047)
	[-0.34, -0.00]				
Decision-Making	0.05	0.07	0.05	0.82	.412 (.415)
	[-0.08, 0.18]				

Note. 95% confidence interval (CI) and standard error estimated by BCa-bootstrapping with 5,000 BCa-samples.

The model regressing team flow on the different subcategories of resources was significant, (R^2 = .35 [adjusted R^2 = .34]; $F(5, 287) = 31.29$, $p < .001$). The resource subcategories communication, shared mental models, supporting behavior and organization/coordination significantly predicted more frequent team flow. Resources regarding leadership did not predict team flow. Table 4.4 gives an overview over the results of the multiple regression. The significant results were confirmed by the bootstrapping analyses.

Table 4.4 *Summary of multiple regression analyses on team flow with resource subcategories of teamwork as predictors (n = 293)*

Predictor	*b [CI]*	SE_b	β	*t*	*p* (p_{boot})
Communication	0.34 [0.11, 0.55]	0.11	0.22	3.48	< .001 (.004)
Supporting behavior	0.23 [0.02, 0.43]	0.10	0.14	2.34	.020 (.023)
Leadership	0.09 [-0.11, 0.29]	0.10	0.06	0.97	.333 (.407)
Shared Mental Models	0.30 [0.12, 0.50]	0.09	0.20	3.56	< .001 (< .001)
Organization/Coordination	0.25 [0.08, 0.42]	0.09	0.17	2.90	.004 (.006)

Note. 95% confidence interval (CI) and standard error estimated by BCa-bootstrapping with 5,000 BCa-samples.

Collective orientation predicted team flow significantly $F(1, 305) = 6.55$, $p = .011$ with $b = 0.20$ [0.05, 0.35], $\beta = 0.15$, $SE = 0.07$, ($t(305) = 2.56$, $p = .011$, $p_{boot} = .008$). The 95% confidence interval and standard error were estimated by BCa-bootstrapping with 5,000 BCa-samples. This positive relationship supports Hypothesis 3.

4.5 Discussion

This study aimed to investigate the relationships of collective orientation, and teamwork stressors and resources in firefighting missions with team flow. Using a questionnaire, we elicited firefighters' experiences regarding teamwork stressors and resources in missions, team flow, and collective orientation. The results of our multiple regression analysis show that frequency of teamwork stressors experienced was negatively associated with team flow. Experiencing stressors in the subcategories leadership, shared mental models, supporting behavior and organization/coordination was found in particular to be negatively related to team flow. On the other hand, frequency of experiencing teamwork resources was positively associated with frequency of team flow. Specifically, we found that experiencing resources in the subcategories communication, shared mental models, supporting behavior

and organization/coordination was significantly positively associated with team flow. Moreover, we found a positive association between collective orientation and team flow.

4.5.1 Stressors and Resources of Teamwork Among Firefighters are Associated with Team Flow

We proposed that experience of teamwork-related *stressors* is negatively associated with team flow (Hypothesis 1), while experience of teamwork-related *resources* is positively associated with team flow (Hypothesis 2). Both hypotheses were supported by the findings in this study. These results are in line with those of Heyne et al. (2011), who found positive associations of flow perceived in teams with different team processes (i.e., perceived sharedness of information, process of team knowledge building). W. D. Russell (2001), in his qualitative analysis of interviews with athletes likewise found that positive team interaction is an antecedent of flow. Moreover, Aubé et al. (2018) reports that teamwork behaviors are positively associated with individual flow. These results may be transferable to the team level.

The relationships found in our study moreover concur with the Transactional Model of Stress and Flow by Peifer and Tan (2021) and expand it to the team level. Teamwork initially creates demands (e.g., communication, coordination) that must be met. Well-functioning processes within the team (e.g., good communication with third parties, supporting behavior) are resources that help to evaluate the situation as a resolvable challenge and to experience team flow. However, in the presence of teamwork-related stressors (e.g., inadequate leadership), the individuals concerned may no longer perceive the situation as challenging, but as stressful. This would lead to reduced team flow. By including team-related stressors and resources in the Transactional Model of Stress and Flow, consideration of the team level succeeds. In this regard, it also supports the assumption that there are additional conditions and characteristics of team flow compared to individual flow (Peifer et al., 2021).

Accordingly, stressors and resources regarding teamwork seem to be important factors that are related to team flow and merit more detailed discussion:

Inadequate leadership was one of the stressors negatively associated with team flow. The subcategory included, for example, insufficient consideration of hazards and operational standards as well as inappropriate behavior by leaders and was related to less frequent team flow. These findings concur with those of van den Hout and Davis (2022), who in an online survey found that inadequate leadership was a factor that hinders team flow. These findings moreover support the assumption that, especially under stress, team management, evaluation of the situation, stress management of oneself and others are important leadership competencies (Flin, 1996). Our results underline that leadership is an important non-technical skill in the context of High Reliability Organizations (HRO). It is well documented that leadership is important for a safe and effective performance in HROs (Flin et al., 2008) and that lack of leadership behavior is related to poorer team performance (Marsch et al., 2004). Our study showed that the effects of leadership also apply to team flow and not only performance. This corroborates findings that flow in teams and team performance are positively related (Aubé et al., 2014; Heyne et al., 2011; van den Hout et al., 2019). Future studies should investigate the extent to which leadership, team performance, and team flow are interrelated and whether team flow could possibly serve as mediating factor between leadership and team performance.

On the other hand, good communication in a firefighting mission was one of the resources positively associated with team flow. For example, the right amount of information and good communication with third parties (e.g., police, railroad employees) were considered in this subcategory, which is related to a more frequent team flow. Again, this finding corroborates that of van den Hout and Davis (2022), who asked participants in an online survey why they experienced team flow and found that open communication was extremely relevant. Moreover, this resonates with earlier descriptions of communication as one of the basic non-technical skills (Flin et al., 2008) for effective teamwork. Furthermore, Nieva et al. (1985) reported that amount of communication is positively associated with team performance in unstructured problem-solving tasks and that intragroup communication does not result in slower problem solving. As flow in teams and team performance are related (Aubé et al., 2014; Heyne et al., 2011; van den Hout et al., 2019), we suggest that the positive effects of communication on team performance may also apply to team flow. Team flow could possibly act as a mediating factor

between successful communication and team performance, which should be investigated in future studies. The finding that team flow is related to communication processes also supports the assumption that *communication and feedback* are team flow characteristics (Peifer et al., 2021).

Other teamwork-related stressors and resources associated with team flow were found in the subcategories shared mental models, supporting behavior and organization/coordination. For example, awareness of a common course of action and skills (items in the subcategory shared mental models) and behaviors of team members (items in the subcategory supporting behavior) seem to be important to experience team flow. This is in line with the findings of Heyne et al. (2011), who found an association between flow in teams and perceived sharedness, a construct closely related to shared mental models. Also, shared mental models are positively associated with team performance (Espevik et al., 2006; Jo, 2012; Johnson & Lee, 2008) and team flow could mediate the relationship between the perception of shared mental models and team performance. This assumption should be investigated in future studies. Moreover, *trust in each other's knowledge, skills, and attitudes* is another core characteristic of team flow introduced by Peifer et al. (2021), resembling shared mental models and underlining that shared mental models could be related to team flow.

Aubé and Rousseau (2005) found that supportive behavior mediates the relationship between team goal commitment and quality of group experience. This is in line with our finding that supporting behavior is positively associated with experience of team flow.

The effective interaction is described by (Quinn, 2005) as an aspect of collective flow. The subcategory organization/coordination in the questionnaire used in this study asks, among other things, to what extent tasks are well distributed so that no individual is overburdened, and to what extent people act on their own initiative. This reflects the requirements for good interaction and emphasizes that coordination can be an important factor in the team flow experience.

Some subcategories were not significantly associated with team flow in the multiple regressions. In the interpretation, care should be taken that the bivariate correlations between the subcategories and team flow become significant in the suspected direction (see Table 4.1). This may suggest that the different subcategories also overlap and accordingly some variance components were better predicted by other

categories, e.g., decision-making could be dependent on leadership and shared mental models or coordination overlaps with communication.

We suggest investigating the relationships between those teamwork processes, team flow, and team performance more closely to find underlying mechanisms. For this purpose, practice missions could be used in which the team processes are evaluated by external observers. Subsequently, both the perceived team flow and the performance would have to be assessed in order to examine correlations more closely.

4.5.2 Collective Orientation is Associated with Team Flow

In line with Hypothesis 3, we found that collective orientation is positively associated with team flow. To the best of our knowledge, there is so far no study investigating the influence of collective orientation on team flow. However, it is well known that collective orientation leads to better performance in interdependent tasks (Driskell et al., 2010; Hagemann, 2017). Given that flow perceived in teams is also positively associated with team performance (Aubé et al., 2014; Heyne et al., 2011; van den Hout et al., 2019) our results offer an explanation why collective orientation can lead to better performance: Team flow could be a link between collective orientation (along with well-functioning team processes) and team performance. Furthermore, collective orientation is positively associated with other teamwork-related constructs like cooperativeness, social interdependence or agreeableness (Driskell et al., 2010; Hagemann, 2017). We propose that these teamwork-related constructs could be connected with some of the characteristics of team flow, like fluent, positive interactions (Pels et al., 2018) and agreement on goals, procedures, and roles (Walker, 2010). Therefore, we assume that collective orientation can enhance team processes and thus could lead to more frequent team flow.

A more advanced approach could be based on the interaction of collective orientation with the stressors and resources of teamwork. As described by Salas et al. (2008), people with a high collective orientation are more aware of their team members' needs and task inputs. Hagemann et al. (2021) demonstrated empirically that teams of people having high collective orientation were more effective in coordination behavior, resulting in better team performance. Therefore, highly collectively oriented individuals contribute through their attitude and their behavior to successful teamwork and should experience more situations in which tasks can be accomplished using teamwork as a resource. On the other hand, if

collective orientation is low, the teamwork may be less effective and the supportive character of teamwork lower. Individuals may consequently experience team resources less often and interpret teamwork situations more often as a stressor. In sum, collective orientation could be positively associated with the perception of teamwork-related resources and negatively with the perception of teamwork-related stressors. These theoretical considerations are supported by the results of this study, as collective orientation is positively correlated with the experience of teamwork-related resources and negatively correlated with the experience of stressors (see Table 4.1). Considering that, according to this study, teamwork resources and stressors are related to the experience of team flow, a mediating effect could be hypothesized. Highly collectively oriented people could experience the resources of teamwork more often, which could lead to more frequent team flow. Conversely, people with low collective orientation could experience fewer resources and more stressors during teamwork-related activities like firefighting missions. This could have a negative effect on team flow. As our data are cross-sectional, we were only able to test these assumptions exploratorily and provide initial circumstantial evidence. It appeared that teamwork stressors and resources could mediate the effect of collective orientation on team flow. However, longitudinal data are needed to adequately examine these effects. Longitudinal data are further necessary to investigate possible other directions of causality of effects, or bi-directional effects. For example, the experience of team flow could also lead to more positive perceptions of team processes. A randomized controlled trial in which one group receives training in non-technical skills and is compared to a group not receiving such training would be highly informative regarding the effects of improved non-technical skills or enhanced collective orientation on team flow. However, acquiring such a specific sample in a longitudinal design is very challenging and was not feasible in the context of this study.

4.6 Practical Implications

The results of our study point to two approaches for increasing team flow: training in non-technical skills and collective orientation. Both approaches are described below.

Training in non-technical skills can be found in Crew Resource Management (CRM) training. Starting in aviation, CRM training addressed the knowledge, skills, and attitudes required for successful teamwork and was adapted to various contexts (Hagemann, 2011; Salas et al., 1999, 2006). For example, Okray and Lubnau II (2004) adapted CRM training to the firefighting context and give an overview of how non-technical skills can be acquired. Hagemann and Kluge (2013) confirmed the effectiveness of a team resource management training for firefighters regarding declarative knowledge acquisition and change in safety-relevant attitudes and behaviors. Accordingly, such existing concepts of non-technical skills training in teamwork-related stressors and strengthen resources.

Since we surveyed very specific teamwork-related stressors and resources in the firefighting context, concrete recommendations for training content to foster team flow (e.g., clear and unambiguous communication strategies) can be derived from these results. The content to be addressed in the training based on the findings in our study is:

(1) Leadership competencies: In German fire departments, training and continuing education for leadership positions are clearly regulated. The leadership training curriculum in professional and voluntary German fire departments includes various modules on leadership techniques, leadership in hazardous situations or legal requirements (AG-B III – LFV NRW, AGBF NRW, WFV NRW, IdF NRW, 2007; AG-F III – LFV NRW, AGBF NRW, WFV NRW, IdF NRW, 2005; Schulte & Thielsch, 2019). The training modules cover topics on the behavior of the leader at the mission site, body language, non-verbal communication methods, stress, and coping with stress. Our study highlights the importance of this training content because, according to our results, the domains taught could affect team flow. It should be noted that there was no systematic tool to evaluate the training concept of leadership training in the fire service until the Feedback Instrument for Rescue Forces Education (FIRE) was introduced in 2018

(Schulte & Thielsch, 2019). Accordingly, it is possible that certain training content important for increasing team flow is taught according to the curriculum but is not adequately internalized by the addressees. Only through systematic evaluation is it possible to determine whether the content taught leads to the desired changes at the knowledge, attitude, and behavioral level. Therefore, FIRE could help to evaluate the quality of leadership training (Schulte & Thielsch, 2019). If necessary, the design could be modified to be more readily internalized, thereby ultimately enhancing team flow.

(2) Coping with poor leadership: While the focus of leadership training is on the leaders themselves, it is also necessary to teach subordinates how to deal with poor leadership behavior. In line with this, T. D. Smith et al. (2016) suggest that an autocratic leadership style in the fire service was often previously perceived as insufficient because subordinates were not involved. Accordingly, subordinates should be taught how to report such deficiencies to the leaders to reduce stressors caused by inadequate leadership behavior. Conversely, leaders should enable subordinates to provide feedback and propose corrections – which is important for successful leadership (Okray & Lubnau II, 2004).

(3) Development of shared mental models: Potential approaches developing shared mental models include guided practice, and feedback mechanisms, e.g., debriefings (Cannon-Bowers et al., 1993; Mathieu et al., 2000). Moreover, job rotation could be another tool to support the development of shared mental models (Mathieu et al., 2000). In firefighting, practice missions focusing on special procedures and discussed in detail afterwards would be appropriate. As in our study, for example, knowledge about skills and behavior of team members proved could be conversations among colleagues in which special skills are reported and procedures for missions discussed on a theoretical level.

(4) Supporting team members: To give team members adequate support the needs of the others must be recognized and training in supporting behavior connected to knowledge about team members' skills and behaviors. Once team members know each other, they can assess whether the other person's behavior is appropriate or whether the other person seems overwhelmed and deviates from their usual patterns of behavior. In this case they can give support. Given the close

connection with the development of shared mental models, the same training methods merit consideration, namely guided practice, job rotation, and debriefing (Cannon-Bowers et al., 1993; Mathieu et al., 2000).

(5) Communication: Okray and Lubnau II (2004) consider communication in their CRM manual for firefighters, offering concrete examples of what content should be covered and how. For example, they describe different types of communication, reasons for communication or the communication system. Our study showed, for example, that the right amount of information and functioning communication with third parties play a role in experiencing team flow and should be specifically addressed in training. Again, debriefings after practice missions could determine how much information was really needed and if this was received.

(6) Organization/coordination: Good communication is very important for successful coordination (Flin et al., 2008). Furthermore, with regard to coordination, fair distribution of tasks/division of labor should be ensured and no one should be overloaded. Debriefings after missions could be helpful to identify potential for improvement in these areas (Hagemann et al., 2022).

These implications apply not only to firefighting; HROs share similar processes and the consequences of teamwork failures are comparable (Hagemann et al., 2011), thus transferability from the firefighting context to other HROs seems reasonable. For example, transfer to emergency medical teams or the police seems logical as similar team processes occur. Nevertheless, these concepts need to be adapted to the specific context of application. The interest in a better team performance in HROs is immense as the consequences of failure can be dire (Hagemann et al., 2011). Different ways to enhance performance should therefore be considered. Increase in team flow that is positively associated with performance (van den Hout et al., 2019) is therefore desirable.

The second approach based on our results is training in collective orientation. Since collective orientation belongs to an approach based on knowledge, skill and attitudes, it can be cultivated via training (Driskell et al., 2010; Hagemann, 2017). Therefore, training in collective orientation could lead via better team processes to more team flow and so to better team performance. This entails finding

decisive factors in collective orientation (Hagemann et al., 2021). For example, Hagemann et al. (2021) propose studying the effects of group incentives systems, leadership style, and team size.

4.6.1 Strengths, Limitations, and Future Directions

To the best of our knowledge our study is the first to investigate how specific teamwork-related stressors and resources influence the experience of team flow in firefighting missions. Since the factors influencing team flow have only rarely been studied, our study provides valuable information on possible contributary factors – like appropriate leadership behavior, good communication, supporting behavior, and shared mental models.

A further strength of our study is its large sample size enabling us to test our assumptions. In addition, we had a highly specific sample that included only firefighters, making it very informative for this specific HRO context.

In the survey, firefighters had to retrospectively answer questions about firefighting missions already experienced. They were asked to aggregate their experiences. With a high level of professional experience and having completed many missions, bias may have occurred during mental aggregation. Future studies should examine whether similar relationships occur when reference is made to a specific situation with no aggregation across different missions. In firefighting, practice missions could be evaluated immediately after execution in terms of the experience of team flow, teamwork-related stressors and resources and could be linked to collective orientation.

Moreover, team flow was assessed on an individual level eliciting participants' experiences of the situations as a team. No values of team members were aggregated or compared to other team members' perceptions, so team flow was defined as a shared experience (van den Hout & Davis, 2019) but assessed at the individual level. Future research should compare the experienced team flow of individual team members to better ascertain whether the entire team perceives the experience similarly or if individual perceptions vary. For example, multi-level models could be used in which the individual's data are nested at team level.

As mentioned above, the data in this study are cross-sectional, so no causal interpretation can be assumed. Accordingly, in this paper we report only associations of teamwork-relevant stressors and resources with team flow. For causal conclusions, longitudinal data or experimental settings would be necessary. Furthermore, common method biases may have occurred because the subjects rated both the stressors and resources and the team flow with self-reports (Podsakoff et al., 2003). To reduce the common method bias in this study, the anonymity of the survey was emphasized and the order of the items on stressors, resources, and team flow was partly randomized to control for reciprocal influences. Nevertheless, future research should use different sources of data to prevent the common method bias even more (Podsakoff et al., 2003). For example, practice missions could be rated by an external observer regarding different stressors and resources of teamwork (e.g., lack of information, hectic behavior of leaders) that occurred.

4.7 Conclusion

Our study investigated the associations between teamwork-related stressors and resources, team flow and collective orientation in the context of firefighting. We provide empirical evidence that team flow is associated with the experience of stressors and resources of teamwork, suggesting additional conditions and characteristics in team flow compared to individual flow. Conditions of team flow therefore need further investigation in different contexts. Collective orientation is positively associated with team flow. Again, this relationship should be addressed in future research with an experimental setting and possible mediating effects.

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Declarations

Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Institutional Ethics Committee of the Faculty of Psychology, Ruhr-University Bochum (no. 482, approval issued on: 3 August 2018).

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5 Study II: The Relationship between Flow Experience and Burnout Symptoms: A Systematic Review

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Only minor formatting changes have been made, e.g., to the font, tables, citation style, presentation of statistics, or figures, in order to achieve a consistent formatting style throughout this thesis.

5.1 Abstract

Background: In today's performance-oriented society, burnout symptoms, defined as consequences of chronic work stress, are an increasing problem. To counteract this development, the important aims are (1) to find protective and modifiable factors that reduce the risk of developing and harboring burnout symptoms and (2) to understand the underlying mechanisms. A phenomenon potentially furthering both aims is flow experience. Based on the earlier literature, we developed a psycho-physiological "Flow-Burnout-Model", which postulates positive or negative associations between flow and burnout symptoms, depending on the prevailing situational and personal conditions. Methods: To test our Flow-Burnout-Model, we conducted a systematic literature search encompassing flow and burnout symptoms. Eighteen empirical studies met the inclusion criteria and were analyzed. Results: The findings of the systematic review as a whole suggest a negative association between flow and burnout symptoms, both cross-sectional and longitudinal. According to the findings from longitudinal studies, flow can be interpreted as a protective factor against burnout symptoms, and burnout symptoms can be interpreted as a factor inhibiting flow. In our conclusion, we maintain the assumption of a bidirectional association between flow and burnout symptoms in the Flow-Burnout-Model but modify the initially suggested positive and negative associations between flow and burnout symptoms towards a predominantly negative relationship. Discussion: Mindful of the heterogeneous findings of earlier studies, the resulting comprehensive Flow-Burnout-Model will lay the foundations for future hypothesis-based research. This includes physiological mechanisms explaining the relationship between flow and burnout symptoms, and likewise, the conditions of their longitudinal association.

Keywords: Flow Experience; Burnout Symptoms; Flow-Burnout-Model

5.2 Introduction

Two colleagues sit together in the same office, working on similar tasks. Both have been working in the company since their traineeships and have now been with the company for 13 years. Despite all these similarities, one worker is completely absorbed in her tasks and enjoys mastering the challenges, while the other worker experience increasing doubts as to whether he is up to the challenges. He feels emotionally exhausted, shows signs of cynicism, and suffers from reduced personal accomplishment. In other words, while the first worker experiences flow (Csíkszentmihályi, 1975) at work, the other worker suffers from burnout symptoms (Maslach et al., 2001). This example shows that individuals may perceive and approach objectively identical tasks and demands at work in completely different ways. While some people seem to handle challenging situations easily, others use maladaptive coping methods to deal with high job demands and consequently suffer from burnout symptoms (Mong & Noguchi, 2021; van der Colff & Rothmann, 2009). But how are these two constructs related, and could they be mutually dependent? To answer this question, the relationship between flow and burnout symptoms will be investigated through a systematic literature review. The results of this systematic review will lay the groundwork for future, hypothesis-based research on the potential role of flow as a factor protecting against burnout emergence and maintenance.

5.2.1 Burnout

Burnout, up to now, is not listed as an independent diagnostic category in the International Classification of Diseases 10 (ICD-10). It is assigned to the residual category Z73 – problems related to life-management difficulty (World Health Organization, 1992). In the ICD-11, it is classified as an occupational phenomenon and defined as “a syndrome conceptualized as resulting from chronic workplace stress that has not been successfully managed” (World Health Organization, 2020). Following the definition by Maslach et al. (2001), the WHO describes three core dimensions of the syndrome: (1) feelings of energy depletion or exhaustion; (2) increased mental distance from one’s job, or feelings of negativism or cynicism related to one’s job; and (3) reduced professional efficacy (World Health Organization, 2020). In addition to the definition used by the WHO, recent research suggests that additional factors should be considered. For instance, Schaufeli et al. (2020) developed the new *Burnout*

Assessment Tool that includes, besides exhaustion, further dimensions such as emotional and cognitive impairment, psychological distress, and psychosomatic complaints.

Given the heterogeneous diagnostic criteria, estimated burnout prevalence must be interpreted with caution (Rotenstein et al., 2018). However, earlier research reports a high prevalence of burnout symptoms and an increasing trend in prevalence (Awa et al., 2010; Maske et al., 2016; Rotenstein et al., 2018; Shanafelt et al., 2015). This trend is exacerbated by the ongoing COVID pandemic (Giusti et al., 2020; Guixia & Hui, 2020).

This increase in burnout prevalence is especially alarming, in light of the severe consequences of burnout symptoms among them impaired life satisfaction (Hakanen & Schaufeli, 2012), cardiovascular diseases (Melamed et al., 2006), increased suicidal ideation (Dyrbye et al., 2008), depressive symptoms (Ahola & Hakanen, 2007), occupational disability (Ahola et al., 2009), job dissatisfaction and low organizational commitment (Maslach & Leiter, 2016), and lower work performance (Demerouti et al., 2014).

Identifying protective factors for burnout symptoms and the underlying mechanism is thus becoming increasingly urgent. The preliminary evidence shows that experienced self-efficacy, for example, can protect against the development of burnout symptoms (Schwarzer & Hallum, 2008). As flow is strongly associated with self-efficacy (Salanova et al., 2006), and as it was found to be associated with problem-focused coping (Pinquart & Silbereisen, 2010), the flow experience could be another promising approach toward reducing the risk of developing and continuing to suffer from burnout symptoms.

5.2.2 Flow

Flow is defined as a rewarding state in which one is completely absorbed and can work on an optimally challenging task (Csíkszentmihályi, 1975). Flow can be characterized by the following three core components: absorption, perceived demands-skill balance, and enjoyment during task performance (Peifer & Engeser, 2021). It is associated with several positive outcomes, such as improved performance (Christandl et al., 2018; Demerouti, 2006; Engeser & Rheinberg, 2008; Rijavec et al., 2017), well-being (Bassi et al., 2014; Rijavec et al., 2017; Rivkin et al., 2018), positive affect (Rogatko, 2009), creativity

(Perry, 2009), and physical health (Hirao et al., 2012). Research shows that it can counteract mental illness symptoms (Riva et al., 2016). Besides the well-studied positive effects of flow, there is also evidence of potential undesired effects, such as impaired risk perception or increased risk of becoming addicted to flow-inducing activity (Zimanyi & Schüler, 2021). Csíkszentmihályi (1990, p. 70) already postulated that "Flow experience, like everything else, is not *good* in an absolute sense".

Since flow is primarily experienced in stress-relevant situations (e.g., teaching (Weimar, 2005); illegal graffiti spraying (Rheinberg & Manig, 2003)), an association between flow experience and psychological and physiological stress seems logical. Peifer and Tan (2021) describe the connection between stress and flow by linking the flow channel model by Csíkszentmihályi (1975) with the Transactional Stress Model proposed by Lazarus and Folkman (1984). The flow channel model illustrates that flow is experienced if skills and demands balance. Furthermore, boredom occurs if the skills exceed the challenges, and anxiety occurs if the challenges exceed the skills (Csíkszentmihályi, 1975). In line with the Transactional Stress Model, Peifer et al. (2014) modified the original flow channel model by adding states they refer to as relaxation and stress. The Transactional Stress Model describes the process of evaluating a situation with the help of various appraisal steps and conveys that individuals experience stress (threat or harm) if the demands of the situation exceed the resources of the person (Lazarus & Folkman, 1984). In this respect, the definitions of anxiety and stress in the corresponding models can be considered equivalent (Peifer & Tan, 2021). Flow occurs in a state between relaxation and stress, when demands can be handled positively (Peifer, 2012; Peifer & Tan, 2021). This notion is in line with Lazarus et al. (1980, p. 209), who describe flow experience as a "powerful sustainer of coping". However, the physiological pattern during flow suggests that it is a state of (at least moderately) increased physiological arousal (Peifer et al., 2014), which underlines an association with stress and a potential relationship with burnout symptoms.

5.2.3 Relationship between Flow and Burnout Symptoms

Given the association between flow and stress (Peifer et al., 2014; Peifer & Tan, 2021) as well as the connection of self-efficacy with both flow (Salanova et al., 2006) and burnout symptoms (Schwarzer & Hallum, 2008), an association between flow and burnout symptoms seems plausible. The present paper

aimes to find a theoretically well-founded model that lays the foundations for hypothesis-driven research in the area of flow and burnout symptoms in future research. To achieve this goal, a three-step approach was applied. (1) First, the Transactional Model of Stress and Flow (Peifer & Tan, 2021) was extended by including burnout symptoms. This newly created Flow-Burnout-Model additionally incorporates relationships between appraisal, physiological patterns, and subjective experiences. Second, (2) the postulated connections between flow and burnout symptoms were examined based on systematic literature analysis. In the final step, (3) the theoretically derived assumptions of the initial Flow-Burnout-Model were aligned with the results of the systematic literature review and, when necessary, adapted.

In summary, the purpose of this review is to develop a comprehensive Flow-Burnout-Model which can be used to generate theoretically sound hypotheses for future research with a special focus on flow as a potential burnout starting point.

5.3 Introducing a Flow-Burnout-Model

The initial Flow-Burnout-Model is based on theoretical considerations. In the following, we present the model in detail by describing its individual components and their interrelationships. The model distinguishes three psychological states: acute stress, relaxation, and flow. It describes the various associations of these states with (1) the appraisal of the situation, (2) physiological arousal, and (3) burnout symptoms.

5.3.1 Appraisal of the Situation

The subjective evaluation of demands and resources or abilities in different situations form the starting point of our initial Flow-Burnout-Model. Hence, we propose that acute stress, relaxation, and flow differ concerning the appraisal of the task demands and the personal abilities necessary to cope with them (Csíkszentmihályi, 1975; Peifer, 2012; Peifer & Tan, 2021). As mentioned above, a perceived imbalance between demands and skills is associated with acute stress (threat or overload, i.e., demands too high related to the person's abilities) or relaxation (underload, i.e., demands too low related to the person's abilities). By contrast, flow experience is associated with a perceived match between demands and skills

(challenge). Peifer and Tan (2021) thus suggest that a potentially stressful situation can be assumed to cause flow experience, acute stress, or relaxation, depending on the subjective appraisal.

5.3.2 Physiological Arousal

Within our initial Flow-Burnout-Model, we propose at least a partial difference between acute stress, relaxation, and flow concerning the physiological states accompanying them. This difference may manifest in the measurable markers of the two systems mainly responsible for the regulation of physiological arousal in humans: (1) the autonomic nervous system (ANS), with its two branches, the sympathetic (SNS) and the parasympathetic nervous system (PNS); and (2) the hypothalamus-pituitary-adrenal (HPA) axis. We, therefore, propose that subjective experiences and physiological arousal are bidirectionally related.

It is well known that acute stress is associated with increased SNS activity and reduced PNS activity (H. S. Kim & Yosipovitch, 2013; von Dawans & Heinrichs, 2017). Also, concerning the HPA axis, acute stress is associated with increased activity as indicated by an almost linear increase in cortisol secretion with rising levels of acute stress (Dusek & Benson, 2009; Foley & Kirschbaum, 2010). Conversely, the relaxation response is characterized by a decreased activation of the SNS and the HPA axis (decreased cortisol secretion, Dusek & Benson, 2009). In a resting state, the influence of the PNS predominates (von Dawans & Heinrichs, 2017).

Flow experience differs from this pattern of physiological arousal. Even though flow-associated patterns of physiological arousal have been far less examined than acute stress and relaxation, the preliminary research suggests an inverted u-shaped relationship between the flow experience and the activation of the HPA axis, and also the SNS (Peifer et al., 2014; Tozman et al., 2017), implying that during flow a moderate level of physiological arousal occurs. Regarding PNS activity, the associations appear to be more complex, as research has revealed another inverted u-shaped relationship with flow (Chin & Kales, 2019) and also generally increased activity of the PNS during flow in stress-relevant contexts (Peifer et al., 2014).

5.3.3 Associations of Stress and Relaxation with Burnout Symptoms

Associations between acute stress, chronic stress, and burnout symptoms are relatively well understood. Exposure to acute stressors comes with increased physiological arousal that can be recovered by an intact PNS (H. S. Kim & Yosipovitch, 2013; von Dawans & Heinrichs, 2017). However, if stressors occur frequently and/or over a longer period, they can be referred to as chronic stressors which come along with prolonged activity (Pieper & Brosschot, 2005). Chronic stress is defined as persistent demands that threaten to exceed the individual's resources (Schetter & Dolbier, 2011). This is considered a cause of burnout symptoms (Riolli & Savicki, 2003); more specifically, chronic work-related stress is a cause of burnout symptoms (Penz et al., 2018).

Interestingly, burnout symptoms are associated with the elevated perception of acute stress (Wekenborg et al., 2019), indicating a bi-directional association between acute stress and burnout.

Associations between relaxation and burnout symptoms are less well understood. Research, however, indicates a negative association between relaxation and burnout symptoms, as relaxation interventions effectively combat burnout symptoms (Awa et al., 2010; Sopezki et al., 2020). Schaufeli (2003) reports that the inability to relax could be both an element and a consequence of burnout or an accompanying symptom. Furthermore, daily relaxation had a negative effect, via reduced work-home interference, on emotional exhaustion and cynicism (Derks & Bakker, 2014).

5.3.4 Associations of Flow with Burnout Symptoms

The direction of the association with burnout symptoms is less straightforward regarding flow experience. In light of theoretical considerations, both positive and negative associations are plausible. On the one hand, in line with the Transactional Model of Stress and Flow (Peifer, 2012; Peifer & Tan, 2021), a negative association between flow and burnout symptoms is likely. Through a cognitive reappraisal of the situation, acute stress is transformed into a flow experience and therefore into a pleasant challenge (Peifer & Tan, 2021). As flow is associated with moderate physiological arousal (Peifer et al., 2014), in comparison with acute stress, the arousal decreases due to the reappraisal. The accumulated stress is alleviated long-term, and burnout symptoms should become less likely.

Furthermore, opposite associations between flow experience and burnout symptoms with meaningful constructs in the work context, such as employee performance (for an overview, see Peifer & Wolters, 2017; Demerouti et al., 2014) and job satisfaction (Maeran & Cangiano, 2013; Maslach & Leiter, 2016) suggest a negative association between the two variables.

On the other hand, it should be considered that the flow state is accompanied by moderate physiological arousal (Peifer et al., 2014). In combination with the potentially addictive nature of the flow experience (Csíkszentmihályi & Rathunde, 1993), this results in a potentially alarming constellation. In line with the principle of operant conditioning, the pleasant feeling during flow and the positive consequences of flow act as a reward (Grüsser et al., 2007). This means that the activities that caused this condition are more likely to be repeated and behavioral addiction could occur, i.e., pathological gaming or excessive shopping. A consequence could be a loss of control, especially concerning the duration and frequency of the behavioral implementation (Grüsser et al., 2007). In the work context, this could, for example, lead to workaholism, which is "considered as one of the most common addictions that can impact different areas of human functioning" (Molino et al., 2016, p. 401) and is defined as an "inner pressures that make the person feel distressed or guilty about not working" (Spence & Robbins, 1992, p. 161). In fact, individuals carry out the flow-promoting activities more often and therefore enter a state of physiological activation repeatedly. In the long run, and without sufficient recovery (Baumann et al., 2016), this constant moderate activation could lead to cumulative strain (Pieper & Brosschot, 2005). Chronic stress and ensuing burnout symptoms are possible consequences (Riolli & Savicki, 2003).

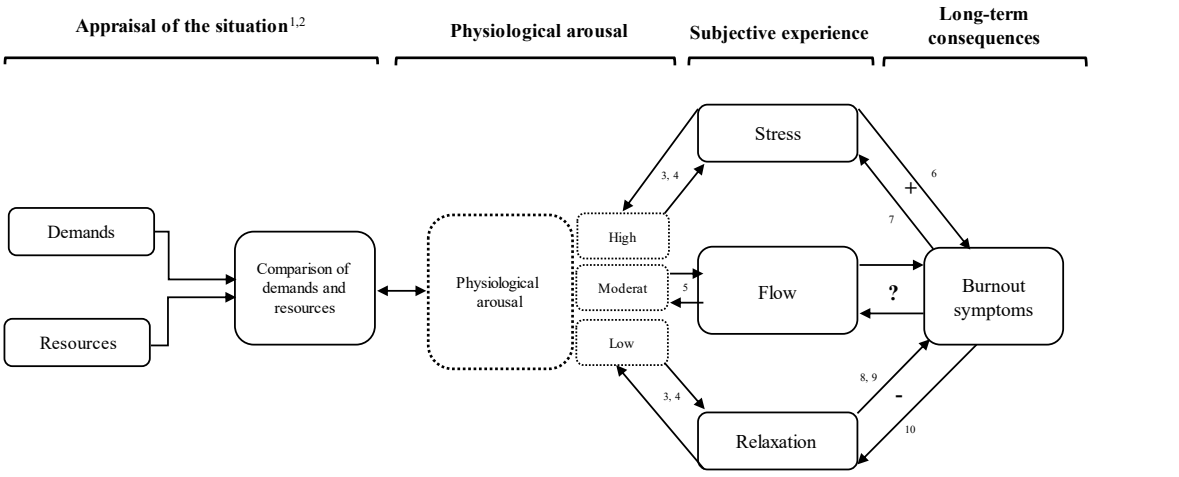
In this context, we would like to emphasize the role of recovery: it was shown that a dynamic balance between demands and skills, including regular phases of rest, enhances the likelihood of experiencing flow (Baumann et al., 2016). This concurs with the findings that individuals who were well recovered in the morning experienced flow more often during the day than individuals who had not recovered (Debus et al., 2014). At the same time, studies show that individuals who do not detach from work have a higher risk of developing burnout symptoms (for an overview, see Sonnentag & Fritz, 2015). Accordingly, sufficient recovery could serve as a moderator of the effects of flow experience on burnout. Flow could be protective as long as sufficient recovery occurs, but as soon as flow coincides with

insufficient recovery due to a loss of control and the development of addictive behavior, it could be conducive to burnout symptoms.

While the theoretical descriptions above suggest that flow can influence burnout symptoms, the causality could also be the other way around: As burnout symptoms are related to depression (Ahola & Hakanen, 2007; Ashraf et al., 2019), a reduction in energy and a decrease in activity (World Health Organization, 1992) may occur and prevent people from engaging in activities that could potentially lead to flow. Therefore, suffering from burnout symptoms may culminate in a reduced ability to experience flow.

Based on the two explanatory approaches, both positive and negative correlations can occur. Figure 5.1 illustrates the described potential relationships between appraisal, physiological arousal, subjective experience and burnout symptoms. This review aims to systematize the findings so far on the relationship between flow and burnout symptoms and to identify the cause-effect relationships. Thus, a model can be created to serve as a basis for further research.

Figure 5.1 *Initial Flow-Burnout-Model (adapted from Peifer, 2012; Peifer & Tan, 2021)*



Note. + = positive association; - = negative association.

5.4 Methods

5.4.1 Search Strategy and Study Eligibility

To identify relevant articles reporting the associations between flow experience and burnout symptoms, a systematic search was carried out in April 2021 using the PubMed, PubPsych, and PsycInfo databases.

The systematic review was conducted with the following search terms ("flow" OR "flow state" OR "flow experience" OR "experience of flow" OR "psychological flow" OR "flow proneness" OR "feeling of being in the zone" OR "optimal experience" OR "absorption" OR "immersion") AND ("burnout" OR "clinical burnout" OR "occupational burnout" OR "work-related exhaustion" OR "job-related exhaustion" OR "job-related stress" OR "work-related stress"). The search terms included synonyms of flow experience used in relevant articles and synonyms of burnout symptoms used in the systematic review by Rotenstein et al. (2018).

The systematic search resulted in 424 papers, and six additional papers were found through an unsystematic search in Google Scholar and a screening of the reference lists of relevant papers. Duplicate entries were removed, resulting in a final sample size of n = 358 articles. The abstracts of these articles were scanned by two authors (F.A., T.B.). With the help of the inclusion or exclusion criteria previously specified, the abstracts were checked for eligibility. For the remaining articles, the full text was read and checked again for compliance with the criteria. Discrepancies between the views of these two authors were resolved through discussion.

5.4.2 Inclusion and Exclusion Criteria

Since this systematic review focused on the relationship between flow and burnout symptoms, publications examining direct relationships between these constructs using a dimensional operationalization were considered, likewise papers investigating categorical group differences. Furthermore, only studies with a quantitative, empirical study design were included in the review. Any country of implementation was accepted. The same applies to the context of the study (e.g., work or study). The systematic review included only studies published in English in peer-reviewed scientific journals that were publicly available. These original papers were only considered eligible if they had not

been published in the form of a systematic or narrative review, study or review protocol, book or book chapter, meta-analysis, case study, opinion, or "practical guideline".

Further restrictions were imposed regarding the survey instrument of the burnout symptoms. Based on O'Connor et al. (2018), we included the following commonly used and validated inventories: Maslach Burnout Inventory (MBI; Maslach & Jackson, 1981), Oldenburg Burnout Inventory (OLBI; Demerouti et al., 2003), Copenhagen Burnout Inventory (CBI; Kristensen et al., 2005); The Burnout Measure (BM; Pines & Aronson, 1988), Psychologists' Burnout Inventory (Ackerley et al., 1988), Organisational Social Context Scale (Glisson et al., 2008), and Professional Quality of Life Scale (ProQOL; Stamm, 2010). Short forms or occupation-specific variants of these measurement instruments, e.g., MBI-Educators Survey (MBI-ES; Schaufeli, Martínez, et al., 2002), were also accepted. No restriction on the operationalization of flow experience was imposed in advance, in order not to further reduce the anticipatedly small number of studies regarding the relationship between flow experience and burnout symptoms. The use of subscales to measure individual sub-dimensions of burnout symptoms or facets of flow experience was declared valid. In contrast, studies on overlapping constructs (i.e., depressive symptoms, chronic fatigue for burnout symptoms and engagement, passion, and relaxation for flow) were excluded.

5.4.3 Data Extraction

Following the screening, information of interest was extracted and tabulated by two of the authors (F.A., T.B.; see Table 5.1). Some studies examined flow and burnout symptoms in larger and more complex models. For the sake of clarity, the focus was placed on the direct association between the two constructs; some broader associations are briefly outlined. Furthermore, for clarity and comprehensibility, the labels of the various subscales were harmonized and reversed recoded where appropriate (e.g., personal accomplishment was referred to as reduced personal accomplishment with reversed scores).

Table 5.1 *Overview of the results of the systematic review regarding design, country, sample, assessment instruments, and associations between flow and burnout symptoms*

Source	Design	Country	Sample	Assessment Instrument		Associations between flow and burnout symptoms
				Flow experience	Burnout symptoms	
Bakker & Geurts, 2004	C-S	Netherlands	• N = 1090 (n_1 = 507; n_2 = 202; n_3 = 381) • Sex ○ Female: 419 (n_1 = 173; n_2 = 126; n_3 = 120) ○ Male: 671 (n_1 = 334; n_2 = 76; n_3 = 261) • Age ○ n_1 = 35 (SD = 9.5) ○ n_2 = 40 (SD = 9.0) ○ n_3 = 40 (SD = 10.4) • Context ○ Pension fund company (n_1) ○ Occupational health services company (n_2) ○ Insurance company (n_3)	• UWES (Schaufeli, Salanova, et al., 2002) ○ AB (6 items)	•MBI-GS (Schaufeli et al., 1996) ○ EE (5 items)	**Correlation** r(AB; EE) = -.16***
Baumgarten et al., 2020	C-S	France	• N = 243 • Sex ○ Female: 64 ○ Male: 179 • Age ○ NR • Context ○ residents (n = 141) ○ neurosurgeons (n = 102)	• WOLF (Bakker, 2008)	• MBI (Maslach & Jackson, 1981)	**Stepwise multiple regression** • EE (Y) ○ AB (X): β = 0.13* ○ EN (X): β = -0.30*** ○ IM (X): n.s. • CY (Y) ○ AB (X): n.s. ○ EN (X): β = -0.25*** ○ IM (X): n.s. • RPA (Y) ○ AB (X): n.s. ○ EN (X): β = -0.19** ○ IM (X): n.s.

Table 5.1 (continued)

Source	Design	Country	Sample	Assessment Instrument		Associations between flow and burnout symptoms
				Flow experience	Burnout symptoms	
Demerouti et al., 2012	LI (diary study – 4 days)	Germany and Netherlands	• *N* = 83 • Sex ○ Female: 49 ○ Male: 34 • Age ○ 41.86 (*SD* = 13.80) • Context ○ Employees from 13 different organizations	• WOLF (Bakker, 2005, 2008) ○ 3 items per subscale	• MBI-GS (Schaufeli et al., 1996) ○ General EE (5 items) ○ EE at work/at bedtime (3 adapted items)	**Correlation** *r*(AB; general EE) = -.12* *r*(AB; EE at work)= -.14* *r*(AB; EE at bedtime) = -.05 *r*(EN; general EE) = -.43** *r*(EN; EE at work)= -.44** *r*(EN; EE at bedtime) = -.37** *r*(IM; general EE) = -.13* *r*(IM; EE at work)= -.10 *r*(IM; EE at bedtime) = -.03 **Multilevel estimates** • EE at work (Y) ○ AB (X): Estimate = -0.07 ○ EN (X): Estimate = -0.19* ○ IM (X): Estimate = -0.07 • EE at bedtime (Y) ○ AB (X): Estimate = -0.05 ○ EN (X): Estimate = -0.17* ○ IM (X): Estimate = -0.13
Kasa & Hassan, 2015[a]	C-S	Malaysia	• *N* = 293 • Sex ○ Female: 99 ○ Male: 194 • Age ○ majority (52.6%) between 20 and 29 • Context ○ Hotel employees	• WOLF (Bakker, 2008)	• OLBI (Demerouti et al., 2010) ○ adapted version	**Correlation** *r*(flow, burnout symptoms): n.s.

Table 5.1 (continued)

Source	Design	Country	Sample	Assessment Instrument		Associations between flow and burnout symptoms
				Flow experience	Burnout symptoms	
Kasa & Hassan, 2016	C-S	Malaysia	• *N* = 317 • Sex ○ Female: 166 ○ Male: 151 • Age ○ majority (70.7%) between 18 and 29 • Context ○ Hotel employees	• WOLF (Bakker, 2008)	• OLBI (Demerouti et al., 2010) ○ adapted version	**Structural model** • flow and burnout symptoms: β = 1.46*
Kasa & Hassan, 2019[a]	C-S	Malaysia	• *N* = 293 • Sex ○ Female: 99 ○ Male: 194 • Age ○ 21 – 29 (53%) ○ 30 – 39 (30%) ○ 40 – 49 (16%) • Context ○ Hotel employees	• WOLF (Bakker, 2008)	• OLBI (Demerouti & Bakker, 2008)	**Regression** • flow (Y) ○ burnout symptoms (X): β = 0.08
Lavigne et al., 2012 (Study 1)	C-S	Canada	• *N* = 113 • Sex ○ Female: 80 ○ Male: 33 • Age ○ 29.43 (*SD* = 4.04) • Context ○ Québec's public service association	• Flow experience at work scale (Forest et al., 2005) ○ adapted from Jackson & Marsh, 1996)	• MBI - French version (Dion & Tessier, 1994)	**Correlation** *r*(flow; EE) = -.10 *r*(flow; CY)= -.44*** *r*(flow; RPA) = -.60***

Table 5.1 (continued)

Source	Design	Country	Sample	Assessment Instrument		Associations between flow and burnout symptoms
				Flow experience	Burnout symptoms	
Lavigne et al., 2012 (Study 2)	LI (T1 and after 6 months T2)	Canada	• *N* = 325 • Sex ○ Female: 172 ○ Male: 153 • Age ○ 44.8 (*SD* = 9.64) • Context ○ Professionals for the Québec government	• Flow experience at work scale (Forest et al., 2005) ○ adapted from Jackson & Marsh, 1996)	• MBI - French version (Dion & Tessier, 1994)	**Correlation** *r*(flow (t1); EE (t1)) = -.42*** *r*(flow (t1); EE (t2)) = -.40*** *r*(flow (t1); CY (t1)) = -.53*** *r*(flow (t1); CY (t2)) = -.54*** *r*(flow (t1); RPA (t1)) = -.66*** *r*(flow (t1); RPA (t2)) = -.51*** *r*(flow (t2); EE (t1)) = -.39*** *r*(flow (t2); EE (t2)) = -.46*** *r*(flow (t2); CY (t1)) = -.52*** *r*(flow (t2); CY (t2)) = -.61*** *r*(flow (t2); RPA (t1)) = -.52*** *r*(flow (t2); RPA (t2)) = -.63***
Ljubin-Golub et al., 2020	C-S	Croatia	• *N* = 213 • Sex ○ Female: 149 ○ Male: 63 ○ 1 data for gender missing • Age ○ 20.32 (*SD* = 2.16) • Context ○ Students	• WOLF-S (Bakker et al., 2017)	• OLBI-S (Demerouti et al., 2003, 2010) ○ adapted Croatian Version	**Correlation** *r*(AB; burnout symptoms) = -.53** *r*(EN; burnout symptoms) = -.60** *r*(IM; burnout symptoms) = -.50**
Mäkikangas et al., 2010	LI (T1, T2, T3 with 6 weeks in between)	Netherlands	• *N* = 335 • Sex ○ Female: 235 ○ Male: 100 • Age ○ 30 (*SD* = 6.0) • Context ○ Employees of an employment agency	• WOLF (Bakker, 2008)	• MBI-GS (Schaufeli et al., 1996) ○ Dutch version ○ EE (5 items)	**Correlation** *r*(flow (t1); EE) = -.34*** *r*(flow (t2); EE) = -.34*** *r*(flow (t3); EE) = -.32***

Table 5.1 (continued)

Source	Design	Country	Sample	Assessment Instrument		Associations between flow and burnout symptoms
				Flow experience	Burnout symptoms	
Martínez-Zaragoza et al., 2014	C-S	Spain	• *N* = 127 • Sex ○ Female: 73 ○ Male: 54 • Age ○ 42.41 (SD = 9.41) • Context ○ Physicians	• Flow Trait Scale-2 (Jackson & Marsh, 1996) in combination with PA ○ Spanish adaption	• MBI-GS (Schaufeli et al., 1996) ○ translated and adapted by Salanova et al. (2000)	**Correlation** *r*(flow + PA; burnout symptoms) = -.08
Martínez-Zaragoza et al., 2017	C-S	Spain	• *N* = 282 • Sex ○ Female: 241 ○ Male: 41 • Age ○ 36.49 (*SD* = 8.95) • Context ○ Registered nurses	• Flow Trait Scale-2 (Jackson & Marsh, 1996) ○ Spanish adaption	• MBI-GS (Schaufeli et al., 1996) ○ translated and adapted by Salanova et al. (2000)	**Correlation** *r*(flow; EE) = -.05 *r*(flow, CY) = -.08 *r*(flow; RPA) = -.32**
Mosing et al., 2018	C-S	Sweden	• *N* = 10.120 • Sex: NR • Age ○ 40.7 (*SD* = 7.75) • Context ○ Swedish Twin Registry	• SFPQ (Ullén et al., 2012)	• MBI-GS (Schaufeli et al., 1996) ○ EE (5 items)	**Correlation** *r*(flow-work; EE) = -.36*** *r*(flow-maintenance, EE) = -.24*** *r*(flow-leisure; EE) = -.23*** *r*(flow-global; EE) = -.34*** *r*(flow-music; EE) = -.03

Table 5.1 (continued)

Source	Design	Country	Sample	Assessment Instrument		Associations between flow and burnout symptoms
				Flow experience	Burnout symptoms	
Rodríguez-Sánchez, Schaufeli, et al., 2011	LI (ESM - 14 days)	Netherlands	• *N* = 100 (40 healthy vs. 60 burned-out) • Sex ○ Female: 59 ($n_{healthy}$ = 26; $n_{burned\text{-}out}$ = 33) ○ Male: 41 ($n_{healthy}$ = 14; $n_{burned\text{-}out}$ = 27) • Age ○ Healthy: 41.8 (*SD* = 10.0) ○ Burned-Out: 42.9 (*SD* = 8.8) • Context ○ Healthy: different occupational groups ○ Burned-out: Dutch centers of expertise in burnout treatment	• UWES (Schaufeli, Salanova, et al., 2002) ○ 2 Items	• MBI-GS - Dutch version (Schaufeli & van Dierendonk, 2000)	**Correlation** *r*(flow; group) = -.29** (person-level) *r*(AB; group) = -.23* (person-level) *r*(EN; group) = -.30** (person-level) *r*(flow; group) = -.13**(time level) *r*(AB; group) = -.11** (time level) *r*(EN; group) = -.14** (time level) **Anova healthy vs burned-out** flow: *t* = 8.70, *p* < .010 AB: *t* = 5.68, *p* < .050 EN: *t* = 9.62, *p* < .050 **Multilevel model** • flow (Y) ○ Group (X): Estimate = -0.36** • AB (Y) ○ Group (X): Estimate = -0.26* • EN (Y) ○ Group (X): Estimate = -0.45***
Schiefele et al., 2013	C-S	Germany	• *N* = 281 • Sex ○ Female: 197 ○ Male: 80 ○ 4 data for gender missing • Age ○ 47.60 (*SD* = 9.82) • Context ○ Teachers at different school forms	• Combination of Flow-Short-Scale (Rheinberg et al., 2003) and scale by Schiefele and Roussakis (2006)	• MBI - German version (Enzmann & Kleiber, 1989)	**Correlation** r_s(flow; EE) = -.14* r_s(flow; CY) = -.24** r_s(flow; RPA) = -.24 **

Table 5.1 (continued)

Source	Design	Country	Sample	Assessment Instrument		Associations between flow and burnout symptoms
				Flow experience	Burnout symptoms	
Xanthopoulou et al., 2018	LI (diary study – 5 days)	Netherlands and Poland	• *N* = 50 • Sex ○ Female: 46 ○ Male: 4 • Age ○ 44 (*SD* = 11.8) • Context ○ Various emotionally demanding, occupational contexts	• WOLF (Bakker, 2008) ○ 10 items ○ adapted version	• MBI-GS (Schaufeli et al., 1996) ○ EE (4 items)	**Correlation** *r*(flow; EE) = -.52** (person-level) *r*(flow; EE) = -.43** (day-level)
Xie et al., 2019	C-S	China	• *N* = 1977 • Sex ○ Female: 1407 ○ Male: 570 • Age ○ 19.90 (*SD* = 1.67) • Context ○ Medical students	• WOLF (Bakker, 2008) ○ modified Chinese version	• MBI-ES (Schaufeli, Martínez, et al., 2002) ○ Chinese version	**Correlation** *r*(flow; burnout symptoms)= -.59**
Zito et al., 2016	C-S	Italy	• *N* = 279 • Sex ○ Female = 201 ○ Male = 78 • Age ○ 42 (*SD* = 8.56) • Context ○ Nurses	• WOLF (Bakker, 2008) ○ translated by Colombo et al. (2013)	• OLBI (Demerouti et al., 2010) ○ EX (8 items)	**Correlation** *r*(flow; EX) = -.54**

Note. C-S = cross-sectional, LI = longitudinal, ESM = Experience Sampling Method, *N* = sample size, *SD* = Standard deviation, WOLF = Work-related Flow Inventory, WOLF-S = WOLF-Study Questionnaire, UWES = Utrecht Work Engagement Scale, SFPQ = Swedish Flow Proneness Questionnaire, MBI = Maslach Burnout Inventory, MBI-GS = Maslach Burnout Inventory - General Survey, MBI-ES = Maslach Burnout Inventory - Educators' Survey, OLBI = Oldenburg Burnout Inventory, OLBI-S = Oldenburg Burnout Inventory - College Students, EE = emotional exhaustion, CY = cynicism, RPA = reduced personal accomplishment, PA = personal accomplishment, EX = exhaustion, AB = absorption, EN = enjoyment, IM = intrinsic motivation, T = timepoint, X = independent variable, Y = dependent variable, n.s. = not significant (statistical parameters not given), NR = not reported
* $p < .050$; ** $p < .010$; *** $p < .001$.
For reasons of clarity and comprehensibility, the labels of the various subscales were harmonized and reversed recoded where appropriate.
[a] The studies may have been based on the same data.

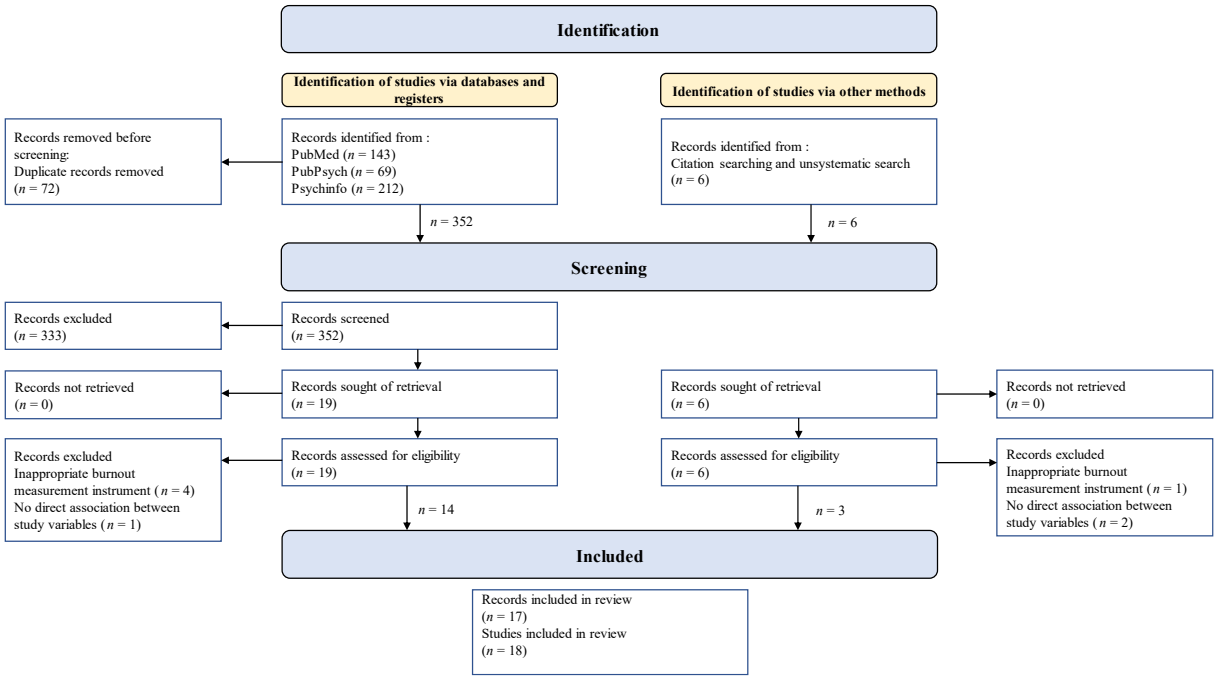
In addition, a modified version of the Newcastle-Ottawa Quality Assessment Scale (NOS; Rotenstein et al., 2018; Stang, 2010) was used to determine a score for each study to ascertain its quality. The criteria for scoring included the representativeness of the sample, its size, the survey instrument of flow experience and burnout symptoms, and the presentation of descriptive statistics (cf. Rotenstein et al., 2018). A maximum of one point could be awarded for each criterion met, resulting in a maximum score of five. Following the original NOS scale (Stang, 2010), the studies could be classified into three graded quality ranges according to the respective total score: high (four to five points), medium (two to three points), and low (zero to one point) quality. The studies used in the systematic review range between 2.5 and 5 points, the majority having four points. The scores for the NOS are presented in the Appendix B – Table A5.1.

5.5 Results

5.5.1 Study Characteristics

The process of identification and selection is depicted in Figure 5.2.

Figure 5.2 *Selection process for the systematic review (adapted from the PRISMA guidelines; Page et al., 2021)*



A detailed overview of the study characteristics is given in Table 5.1, in alphabetical order. The systematic review includes 18 studies reported in 17 articles.

The studies were published between 2004 and 2020. Concerning study design, 13 of the studies included were cross-sectional, and five were longitudinal.

Overall, 16,521 individuals participated in the studies. The number of participants ranged between 50 and 10,120 per study. With respect to demographic characteristics, 3756 of these participants were female, 2640 male, and five individuals did not report their sex. One study did not report gender percentages of the total sample. Most studies reported a mean age between 29 and 48, whereas in two studies the mean age was under 21, and one study did not report age ranges.

The studies were carried out in eleven different countries, most of them in the Netherlands (n = 5), followed by Malaysia (n = 3), Germany (n = 2), Canada (n = 2) and Spain (n = 2). One study each was carried out in China, Croatia, France, Italy, Poland, and Sweden. Most studies (n = 14) were carried out in the work context, three in an educational setting and one in a more general context. Most studies operationalized burnout symptoms with a version of the MBI (n = 13). Thus, either an MBI sum score (n = 3) and/or its sub-dimensions (emotional exhaustion (n = 10), cynicism (n = 5), reduced personal accomplishment (n = 5)) were used. Five studies used the OLBI or an adapted version thereof. Here, an OLBI sum score (n = 4) and/or its sub-dimensions (exhaustion (n = 1), disengagement) were also used. None of the other burnout measurements mentioned above were used in the studies scrutinized.

Flow was predominantly operationalized using the Work-related Flow Inventory (WOLF) or adaptions thereof (n = 10) and its facets absorption, enjoyment, and intrinsic motivation, followed by the subscales or single items of the Utrecht Work Engagement Scale (UWES; n = 2), the flow experience at work scale (n = 2), the Flow Trait Scale-2 (n = 2), the Swedish Flow Proneness Questionnaire (n = 1) or a combination of the Flow-Short-Scale and a scale developed by Schiefele and Roussakis (2006) (n = 1).

All details can be found in Table 5.1.

5.5.2 Relationship between Flow and Burnout Symptoms

In the interests of clarity in the following, the results on the relationship between flow and burnout symptoms are presented systematically, based on (1) cross-sectional vs. longitudinal study designs and (2) the respective burnout measures used. Multifactorial analyses that include different influencing factors are also described.

5.5.2.1 Associations between Flow and Burnout Symptoms in Cross-Sectional Studies

Most cross-sectional studies used correlative analyses to examine the association between flow and burnout symptoms (n = 10). Three studies used other statistical methods to investigate the relationship.

Associations between Flow and Burnout Symptoms Measured with the MBI

Two studies used MBI sum scores to operationalize burnout symptoms. Xie et al. (2019) used a sum score that included all three MBI sub-dimensions and found a significant negative association with flow (r = -.59) among Chinese medical students (academic burnout, Xie et al., 2019). Flow was operationalized with a sum score of an adapted version of the WOLF, which included the three facets absorption, enjoyment, and intrinsic learning motivation. Martínez-Zaragoza et al. (2014), who built an MBI sum score based on the sub-dimension emotional exhaustion and cynicism, found no significant association with professional flow (operationalized as a sum score of the Flow Trait Scale-2 and the MBI sub-dimension personal accomplishment).

Three out of the five studies examining the relationship between flow and the sub-dimension emotional exhaustion, with the help of correlations, found significant negative correlations (rs between -.14 and -.36; (Bakker & Geurts, 2004; Mosing et al., 2018; Schiefele et al., 2013)). Bakker and Geurts (2004) used the six-item subscale absorption of the UWES to measure flow, Schiefele et al. (2013) used a sum score of an adapted version of the Flow-Short-Scale in combination with a scale developed by Schiefele and Roussakis (2006) and Mosing et al. (2018) investigated the relationship between flow in different contexts (global, work, leisure, maintenance, and music) and emotional exhaustion using the SFPQ. Significant negative associations were found for the global score and flow at work, leisure, and maintenance, but not for flow in music. On the other hand, two studies found no significant association

between flow and emotional exhaustion (Lavigne et al., 2012; Martínez-Zaragoza et al., 2017). While Lavigne et al. (2012) measured flow with a sum score of the flow experience at work scale with the facets concentration, control, and autotelic experience, Martínez-Zaragoza et al. (2017) used a sum score of the Flow Trait Scale-2.

Three of the studies mentioned above additionally examined associations between cynicism, reduced personal accomplishment and flow (Lavigne et al., 2012; Martínez-Zaragoza et al., 2017; Schiefele et al., 2013). Concerning cynicism, two studies found significant negative associations with flow (*rs* between -.24 and -.44; Lavigne et al., 2012; Schiefele et al., 2013). Reduced personal accomplishment was negatively associated with flow in all these three studies (*rs* between -.24 and -.60).

Baumgarten et al. (2020) used multiple stepwise regression to investigate which factors influenced the three MBI sub-dimensions of burnout. They entered personal and psychosocial factors into the models to explain burnout symptoms, including the flow facets absorption, enjoyment, and intrinsic motivation. Enjoyment was a significant negative predictor for all MBI sub-dimensions (β between -0.19 and -0.30). Absorption only predicted emotional exhaustion symptoms (β = 0.13, p = .030) significantly positively. Intrinsic motivation did not predict any sub-dimension of burnout symptoms.

Associations between Flow and Burnout Symptoms Measured with the OLBI

Only five studies examined the associations between flow and burnout symptoms using the OLBI. Kasa and Hassan (2015) and Ljubin-Golub et al. (2020) used the sum score of the OLBI, including the sub-dimensions exhaustion and disengagement. While Ljubin-Golub et al. (2020) found negative correlations between all flow facets measured with the WOLF-S and the OLBI sum score (absorption: r = -.53, enjoyment: r = -.60, intrinsic motivation: r = -.50), Kasa and Hassan (2015) found no significant correlation between flow measured with an adapted version of the WOLF and the OLBI sum score. In a subsequent study, Kasa and Hassan (2016) found in a structural equation model that flow was positively associated with the OLBI sum score (β = 1.46), which is in contrast to the findings of other studies.

Zito et al. (2016) found negative associations between the OLBI sub-dimension exhaustion and flow, operationalized as the sum score of the WOLF (r = -.54). Kasa and Hassan (2019) found that the a-path in their mediation model from burnout symptoms (OLBI sum score) to flow was not significant.

5.5.2.2 Associations between Flow and Burnout Symptoms in Longitudinal Studies

All longitudinal studies operationalized burnout symptoms using the MBI. Demerouti et al. (2012) investigated in a diary study over four days if flow during the working day predicted (1) general emotional exhaustion, (2) exhaustion at work, and (3) exhaustion at home/bedtime. To measure flow, they used three items of each of the flow facets of the WOLF (absorption, enjoyment, intrinsic motivation). All three flow facets, as well as exhaustion at work and exhaustion at home/bedtime, were averaged over the diary days. All three flow facets correlated negatively with general emotional exhaustion (*rs* between -.12 and -.43). In contrast, emotional exhaustion at work correlated negatively only with absorption (r = -.14) and enjoyment (r = -.44). Emotional exhaustion at bedtime was negatively associated with enjoyment (r = -.37). Multi-level analysis revealed that emotional exhaustion at work (β = -0.19, $p < .050$) and at bedtime (β = -0.17, $p < .050$) were only predicted by enjoyment after controlling for nationality, age, presence of children, working hours, and general exhaustion, then again finding negative relationships.

Similar patterns were found in another diary study by Xanthopoulou et al. (2018), who collected data over five days. Here, too, flow scores (sum score of an adapted version of WOLF) and emotional exhaustion were aggregated over these five days and were significantly negatively associated (r = -.52). At day-level, the correlation was r = -.43.

Lavigne et al. (2012) collected data at two measurement points (T1 and T2) with a time-lag of six months. They used a flow sum score of the flow experience at work scale and the three sub-dimensions of burnout symptoms, measured with the MBI. Flow, measured at T1 and T2, was negatively correlated with emotional exhaustion, cynicism, and reduced personal accomplishment at both measurement points. Correlation coefficients ranged between r = -.42 and r = -.66 for cross-sectional and r = -.39 to r = -.54 for longitudinal associations.

Mäkikangas et al. (2010) conducted a study with three measurement points, each with a time-lag of six weeks. Emotional exhaustion, measured only at T1, was negatively associated with flow (operationalized with a sum score of the WOLF) at T1 (r = -.34), T2 (r = -.34), and T3 (r = -.32).

Rodríguez-Sánchez, Schaufeli, et al. (2011) conducted a group comparison. They used the cut-off value of an MBI sum score introduced by Schaufeli et al. (2001) to divide the sample into a healthy group and a group suffering from burnout symptoms and collected data via the Experiencing Sampling Method (ESM). The correlation on a personal level (aggregated over 15 days) showed that flow, measured with two items from the UWES, was negatively associated with group affiliation, indicating that burned-out individuals experience less flow (r = -.29). The same pattern was found for the flow facets absorption and enjoyment (r = -.23 and r = -.30). On a timelevel, these results were also found (rs between -.11 and -.14). Multivariate ANOVA moreover revealed significant group differences regarding the total score for flow (t = 8.70, p < .010), and the facets enjoyment (t = 9.62, p < .050) and absorption (t = 5.68, p < .050). In addition, a multilevel model showed that group affiliation (healthy vs. burned-out) significantly predicted flow experience over time (β = -0.36, p < .010) when controlling for the effects of time and weekdays. This pattern was also found for the two facets of flow – enjoyment (β = -0.45, p < .001) and absorption (β = -0.26, p < .050).

Table 5.2 provides an overview of how many studies found a positive, negative, or non-significant association between flow and burnout symptoms. Since some studies examined several correlations (e.g., investigating all three flow facets or burnout sub-dimensions) or obtained different results using different analysis methods, the number of studies given does not add up to 18. Most studies (n = 6) found a negative relationship between flow and emotional exhaustion. Non-significant results between the same constructs were reported four times. The enjoyment facet showed exclusively negative associations with the various burnout symptoms. In four studies, reduced personal accomplishment was negatively associated with flow.

Table 5.2 *Overview of the positive, negative and non-significant associations found in the studies*

Relationship	Flow	Burnout symptoms			
		Total score	EE/EX	CY	RPA
Positive association	Total score	1			
	AB		1		
	EN				
	IM				
Negative association	Total score	2	6	3	4
	AB	2	2		
	EN	2	2	1	1
	IM	1	1		
Non-significant association	Total score	3	3	1	
	AB		1	1	1
	EN				
	IM		2	1	1

Note. EE = emotional exhaustion, EX = exhaustion, CY = cynicism, RPA = reduced personal accomplishment, AB = absorption, EN = enjoyment, IM = intrinsic motivation. The results from Table 5.1 are summarized. Further associations with other influential factors are not considered.

5.5.2.3 Multifactorial Associations between Flow and Burnout Symptoms

In addition to reporting relationships between flow and burnout symptoms, other complex explanatory models were investigated, including various influencing factors. An overview is given in Table A5.2 in Appendix B.

Nine cross-sectional and four longitudinal studies used different models that included flow and burnout symptoms as factors. A serial mediation model used by Ljubin-Golub et al. (2020) showed that the relationship between the teacher's autonomy support and burnout symptoms (OLBI sum score) was mediated by autonomous motivation and study-related flow. Their model with burnout symptoms as a mediator between autonomous motivation and flow did not fit satisfactorily. In another mediation model, it was shown that flow serves as a mediator between job demands/job resources and the OLBI sub-dimension exhaustion (Zito et al., 2016). Mäkikangas et al. (2010) could find no hypothesized moderating effect of burnout symptoms on the relationship between job resources and flow. In their

latent growth curve model, it was shown that the initial level of emotional exhaustion was negatively associated with the initial level of flow and job resources. However, exhaustion did not significantly predict changes in flow experience or job resources over time.

Demerouti et al. (2012) found that the interaction between enjoyment and recovery at work predicted emotional exhaustion at work. For participants with low recovery after breaks at work, enjoyment was negatively associated with emotional exhaustion at the end of the working day. For participants with sufficient recovery after breaks, no such relationship was found. Furthermore, the interaction between enjoyment and detachment significantly predicted emotional exhaustion at bedtime. Participants with high levels of enjoyment and detachment scored lower on emotional exhaustion than those with lower levels of detachment. Interactions with absorption and intrinsic motivation were not significant.

In their structural and measurement model describing the relationships between flow, health, burnout, and approach coping, Martínez-Zaragoza et al. (2017) found a negative association between flow and reduced personal accomplishment. However, Schiefele et al. (2013) used a structural equation model in which burnout symptoms and flow were integrated as outcome variables for dimensions of interest and self-efficacy. In this model, the burnout symptoms and flow were not associated.

Kasa and Hassan (2019) found no evidence for flow as a mediator between burnout symptoms and work-family conflicts. Furthermore, they found no mediating effect of flow between burnout symptoms and Organizational Citizenship Behaviour (Kasa & Hassan, 2015). Socio-culture factors did not moderate the relationship between burnout symptoms and flow (Kasa & Hassan, 2016).

Lavigne et al. (2012) used path analyses to test if flow experience mediates the relationship between harmonious passion and the three sub-dimensions of the MBI. They found that flow was a mediator between harmonious passion and cynicism as well as between harmonious passion and reduced personal accomplishment. The mediation model with emotional exhaustion as the outcome was not significant. They also hypothesized that flow acts as a mediator between obsessive passion and the sub-dimensions of the MBI, but these assumptions could not be confirmed. Additionally, they tested a model that used the sub-dimensions of burnout as mediators and flow experience as a dependent variable. This model was found to have a less satisfactory fit. In their longitudinal study, Lavigne et al. (2012) reported that

harmonious passion measured at T1 was significantly associated with all MBI sub-dimensions at T2. This relationship was mediated by flow experience at T2. Again, these results of mediation could not be found for obsessive passion. It should be noted that non-significant paths were removed in the final model, indicating that flow at T1 did not predict burnout symptoms at T2.

In their multilevel path analysis, Xanthopoulou et al. (2018) used deep acting and surface acting as predictors for flow and emotional exhaustion, both of which affected the need for recovery at the end of the working day, relaxation during leisure, and vigor at bedtime. In this complex model, flow and burnout symptoms were significantly negatively associated (b = -0.07).

Mosing et al. (2018) found in their twin study that the genetic correlation between flow proneness and emotional exhaustion was r_g = -.58 and the environmental correlation r_e = -.23. When controlling for shared genetic and familial factors, the correlation between flow proneness and emotional exhaustion was still significant (r = -.23).

5.6 Discussion

This article aimed to (1) develop a theoretically based Flow-Burnout-Model, (2) examine the relationship between flow and burnout symptoms with the help of a systematic review, and (3) adapt the initial Flow-Burnout-Model regarding the results of the systematic review.

The initial Burnout-Flow-Model, which is based on the Transactional Model of Stress and Flow (Peifer & Tan, 2021), presents an explanatory approach to describe the relationship between flow and burnout symptoms, as well as the moderating and mediating factors of this association. In light of the existing literature, we proposed that the appraisal of resources and demands leads to different states of arousal, which are perceived as subjectively different (Peifer & Tan, 2021). If the demands exceed the resources, individuals feel stressed (Peifer & Tan, 2021), which is associated with increased physiological arousal (Dusek & Benson, 2009). Conversely, relaxation is experienced as soon as the resources exceed the demands (Peifer & Tan, 2021). Physiological arousal is then low (Dusek & Benson, 2009). Flow seems to be a state lying between the states of stress and relaxation, at a moderate level of arousal (Peifer et

al., 2014). There is evidence that flow is experienced in stress-relevant situations (Csíkszentmihályi, 1975; Rheinberg & Manig, 2003) which are perceived as challenges (Mesurado et al., 2016).

The relationships between stress, relaxation, and burnout symptoms have been well studied. Burnout symptoms are a consequence of chronic stress (Riolli & Savicki, 2003). With relaxation, burnout symptoms depict negative associations (Awa et al., 2010; Derks & Bakker, 2014; Schaufeli, 2003). However, the relationship between flow and burnout symptoms is less well understood.

In the following, the results of the systematic review are summarized and discussed. The review considers the empirical evidence of the relationship between flow and burnout symptoms. Based on these findings, the initially proposed Flow-Burnout-Model is adapted and presented.

5.6.1 Discussion of the Systematic Literature Review

In summary, the results of the present systematic review provide convincing evidence for a significant association between flow and burnout symptoms. Hence, the vast majority of studies reported a negative relationship between these two constructs, i.e., increased levels of flow are related to reduced burnout symptoms.

These findings concur with the assumption of the initial Flow-Burnout-Model proposing that enhanced flow experience could serve as a buffer against accumulated acute stress experiences and could, therefore, protect in the long run against burnout symptoms. Furthermore, our review underlines the findings of the existing literature in the field of positive psychology that characterizes flow experience as an important promoter of health and well-being (Bassi et al., 2014; Rijavec et al., 2017; Rivkin et al., 2018). The health-promoting effects of flow are at odds with the already demonstrated consequences of burnout symptoms. Additionally, flow is positively associated with positive affect (Rogatko, 2009) and negatively with negative affect (Collins et al., 2009), while burnout symptoms are negatively associated with positive affect and positively with negative effect (Little et al., 2007). Therefore, increased positive and decreased negative affect could mediate between flow and burnout symptoms.

Based on our findings, future consideration of the relationship between flow and burnout symptoms seems reasonable.

However, our review also includes studies reporting positive as well as non-significant associations between flow and burnout symptoms; these require closer examination. The positive associations may indicate that flow experience is potentially addictive (Csíkszentmihályi & Rathunde, 1993) and could thus lead to a form of workaholism, which in turn is associated positively with burnout symptoms (Moyer et al., 2017). The non-significant results, on the other hand, could indicate that causality can occur in parallel, their effects thereby possibly canceling each other out. Future research should investigate with the help of mediators, e.g., feeling of addiction, if both effects appear. Differences between the studies regarding sample size and composition, as well as methodological aspects, may account for these mixed results. In the following, their influence on the results revealed will be discussed.

5.6.2 Influence of Additional Variables and Methodology

Overall, the fact that negative correlations between the two constructs were shown across a wide variety of sample compositions concerning age, occupation, sex, nationality, and measurement instruments underlines the robustness of the effects reported.

However, certain variables seem to influence the directionality and extent of these effects. First, two out of three studies that failed to find any significant associations between flow and burnout symptoms examined employees in the Malaysian hotel industry. Accordingly, occupational group and culture may be relevant factors to be considered in future studies. The third study conducted in the Malaysian hotel industry actually found a strong positive association between flow and burnout symptoms, in contrast to the majority of studies, which found a negative association between flow and burnout symptoms. This underlines the assumption that occupational group or culture could be relevant moderators of the association between flow and burnout symptoms. All three studies used the same methodology (OLBI sum score and WOLF sum score) to measure flow and burnout symptoms. To further investigate cultural differences in the relationship between flow and burnout symptoms, more studies should be conducted in countries that differ in their culture and social system, as most studies identified within the present systematic review were conducted in Europe.

Second, our systematic review revealed wide differences in the operationalization of flow and burnout symptoms between the studies included. Flow experience was most often measured with sum scores (*n* = 13), but few studies differentiated between facets of flow (*n* = 4). Only one study reported a sum score and individual facets of flow (*n* = 1). For burnout symptoms, only a few studies used a sum score (*n* = 6), whereas most studies referred to individual burnout sub-dimensions (*n* = 11). Here, too, only one study reported a sum score and individual burnout sub-dimensions (*n* = 1). In addition, one study reported results for three burnout sub-dimensions and three flow facets. More importantly, these differences affected the associations found between flow and burnout symptoms. In the following, we present an overview of the results reliant on the methodology used. Because some studies examined multiple flow facets or burnout sub-dimensions simultaneously and also found both positive, non-significant, or negative associations among the different facets, the results in Table 5.2 are not limited to the 18 studies reported. In the following compilation of results, some of the findings are further summarized.

5.6.2.1 Facets of Flow and Burnout Symptoms

In the majority of cases, a negative correlation between flow and burnout symptoms was found (compare Table 5.2). Nevertheless, the inconsistent results for the facets of flow should be mentioned: In the studies scrutinizing the different facets of flow separately, enjoyment, in particular, showed high negative correlations with burnout symptoms. As every study (*n* = 4) that addressed this facet reported significant negative correlations between enjoyment and burnout symptoms, this finding can be considered very stable. This leads to the assumption that enjoyment, in particular, could be the driving force explaining the protective effect of flow experience on burnout symptoms. This is in line with the interpretation suggested by Baumgarten et al. (Baumann et al., 2016), namely that enjoyment during working hours should be seen as a protective factor against emotional exhaustion and feelings of cynicism. The importance of enjoyment could stem from the fact that, as a positive emotion, it helps to better relieve stressful situations and to show the positive meaning in these situations (Tugade & Fredrickson, 2004). In this way acute as well as long-term chronic stress and, consequently, burnout symptoms, would be counteracted.

The results regarding the facet of absorption (n = 5) were not entirely consistent. It was found that there were more negative associations with burnout symptoms than positive associations, but there were also some non-significant associations. The negative associations with absorption were found with emotional exhaustion, the MBI-GS and OLBI-S sum score for burnout. Relationships between absorption, reduced personal accomplishment, and cynicism were only reported in one study and were not significant. One study found that absorption was the only flow facet associated with an exacerbation of exhaustion symptoms. This finding substantiates the hypothesis that flow experience has an addictive potential (Csíkszentmihályi & Rathunde, 1993) that may eventually result in increased exhaustion. Such reasoning is further supported by the positive correlations between excessive working and exhaustion (Baumgarten et al., 2020) on the one hand and excessive working and absorption (Hakanen et al., 2012) on the other. This permits the assumption that absorption leads to symptoms of emotional exhaustion via workaholism.

The facet of intrinsic motivation was rarely considered in the studies (n = 3). Two negative associations emerged (OLBI-S sum score and general emotional exhaustion). On the other hand, associations between intrinsic motivation and emotional exhaustion at work/bedtime and associations between intrinsic motivation and the three MBI sub-dimensions were not significant. This may suggest on the one hand that this facet of flow is less strongly related to burnout symptoms, or, on the other hand, that intrinsic motivation could be positively and negatively associated with burnout symptoms with different mechanisms of action that cancel each other out. More research is needed to investigate the different various possible effects.

Overall, the enjoyment facet is most consistently associated with burnout symptoms, as there are only findings of a negative relationship. Nor can associations be found as consistently for intrinsic motivation and absorption. There were some non-significant associations for intrinsic motivation with burnout symptoms in addition to the few negative correlations. For absorption, there were a few negative associations, but non-significant results were also found, along with one positive correlation. Based on these results, we suggest that the various facets may affect burnout symptoms differently and should also be explored separately in future research. Nevertheless, it should be noted that flow experience is a

state in which absorption, enjoyment, and intrinsic motivation coincide (Bakker, 2008), and an exclusive focus on individual facets may not adequately cover interrelationships with the overall construct. Accordingly, the overall flow score should always be considered while investigating the associations with burnout symptoms.

5.6.2.2 Sub-Dimensions of Burnout

As described above, burnout symptoms were measured in many different ways. Most studies focused on the sub-dimension of emotional exhaustion (n = 10) while a few reported the sub-dimension of cynicism (n = 5) and also reduced personal accomplishment (n = 5). There was no obvious pattern whereby certain sub-dimensions were more closely related to flow as effect sizes varied between studies. However, as soon as reduced personal accomplishment was measured, negative correlations emerged with at least one facet of flow, which indicates a very constant relationship. For cynicism, one out of five studies found no significant relationship, while for emotional exhaustion, which was the most frequently examined, two out of ten studies found no relationship to flow at all.

Table 5.2 indicates that, especially regarding emotional exhaustion, non-significant associations with flow were frequently reported. On the one hand, this could be because emotional exhaustion is the burnout sub-dimension that has been most frequently studied. On the other hand, it could indicate that the association between flow and emotional exhaustion is not as consistent as with other burnout sub-dimensions.

Nevertheless, four studies showed a negative association between cynicism and flow, and eight studies revealed a negative association between emotional exhaustion and at least one facet of flow. Furthermore, there was a significantly negative association between exhaustion (measured with the OLBI) and flow. Accordingly, it can be assumed that the various sub-dimensions of burnout are all related to flow or facets of flow.

5.6.3 Causal Relationship between Flow and Burnout Symptoms

To examine the causal direction of the effect, the results of the longitudinal studies (n = 5) merit attention. Both the interval of a few hours (Demerouti et al., 2012) and several months between the

measurement of flow experience and burnout symptoms (Lavigne et al., 2012) (study 2) showed that more frequent flow experience led to lower burnout symptoms. The results permit the assumption that flow experience has a protective effect against burnout symptoms. If future studies confirm the durability of flow-associated reduction in burnout symptoms, setting up flow-promoting workplaces could be a promising approach. As flow experience can be promoted by creating conditions conducive to flow (for an overview, see Peifer & Wolters, 2021), the construct provides a promising approach to proactively prevent burnout symptoms. Since interventions to increase flow experience could be applied at different levels, both the individual and the organization can increase the flow experience at work (e.g., setting clear goals, coaching from the supervisor, Peifer & Wolters, 2021). Flow experience can only occur under certain conditions (Barthelmäs & Keller, 2021). In the future, studies should investigate to what extent flow can be seen as a protective factor against burnout symptoms or whether accompanying circumstances (e.g., clear goals, unambiguous feedback, perceived demand-skill balance, Barthelmäs & Keller, 2021) exert these protective effects of flow.

In their longitudinal study, Mäkikangas et al. (2010) open up a different perspective. They suggest that people with higher emotional exhaustion symptoms experience less flow. Thus, the previously assumed perspective on exhaustion as a depleted state could come into focus, as individuals suffering from burnout symptoms cannot focus all abilities on work demands and further cannot achieve the flow state. Consequently, the buffering effect of the flow experience would be suppressed by already existing burnout symptoms, such as emotional exhaustion. These results are in line with those of Rodríguez-Sánchez, Schaufeli, et al. (2011), who showed that the respective group affiliation (burned-out vs. healthy) was predictive of flow experience, which suggests a flow-inhibiting effect of burnout symptoms. This finding suggests that individuals with high levels of burnout symptoms cannot experience flow in the way healthy people can. The positive consequences of flow (e.g., well-being and performance, Rijavec et al., 2017) can therefore not occur, which leads to a vicious circle. In contrast, Lavigne et al. (2012) tested a model in which burnout symptoms predicted flow. However, their model was less satisfactory than the one that reported the reverse effect (flow predicted burnout symptoms), indicating an unidirectional rather than a bidirectional effect. These results align with the cross-sectional

study by Ljubin-Golub et al. (2020), who found that the model with burnout symptoms as a mediator between autonomous motivation and flow was not as satisfactory as the model that used flow as a mediator between autonomous motivation and burnout symptoms. These disparate results underline the importance of studies that examine both effects on the same data basis using longitudinal studies.

5.6.4 Further Relationships

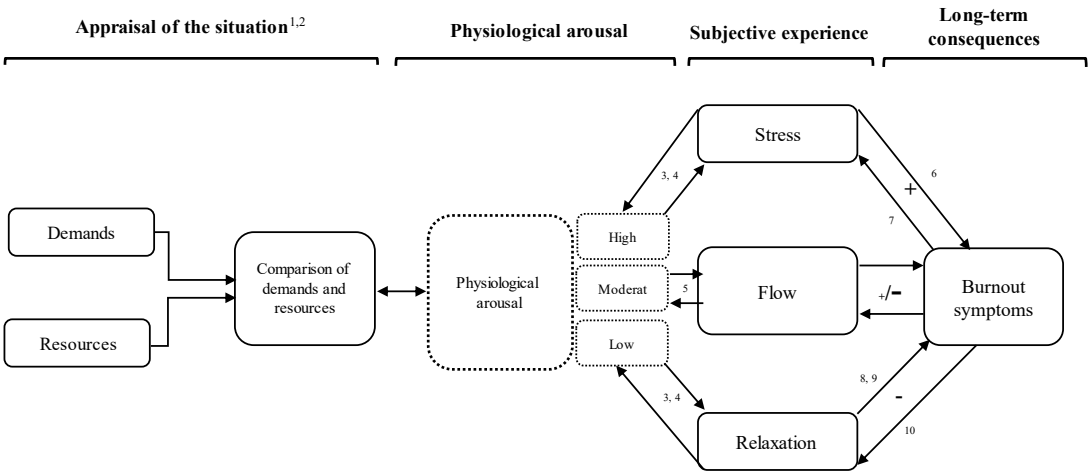
Although the focus of the systematic review was on the direct relationship between flow experience and burnout symptoms, several other variables seem to influence this relationship. In the work context, harmonious, i.e., non-obsessive, passion for the job (Lavigne et al., 2012) and the presence of work-related resources (Zito et al., 2016) facilitate flow experience, whereas flow experience becomes less likely with increased work demands (Zito et al., 2016). In the educational context, autonomous motivation favors the flow experience (Ljubin-Golub et al., 2020). Specific behavior also seems to make a difference in whether or how well flow experience serves as a protective factor. While mental distancing from work content helps, high recovery after breaks during working time has been shown to inhibit the positive effect of enjoyment on alleviating exhaustion (Demerouti et al., 2012). The latter could be attributable to the flow experience being interrupted by breaks, and thus its effect on reducing burnout symptoms is blocked (Demerouti et al., 2012). Another approach is that genetic factors can influence the relationship between flow and burnout symptoms (Mosing et al., 2018). This could mean there are interindividual differences in the relationship between the two constructs. The protective effect of flow proneness on emotional exhaustion was still significant after controlling for shared genetic and familial factors (Mosing et al., 2018).

Our systematic review shows that research in the area of burnout and flow experience is very diverse and linked to different constructs as many studies investigated the relationship between flow and burnout symptoms in combination with other factors. In this review, the focus was on the relationship between flow and burnout symptoms. However, in the future, other influential factors, such as recovery or passion, should also be considered in more detail.

5.6.5 The Flow-Burnout-Model

Regarding the results of the systematic review, the initial Flow-Burnout-Model can be adapted (see Figure 5.3):

Figure 5.3 *Adapted Flow-Burnout-Model (adapted from Peifer, 2012; Peifer & Tan, 2021)*



Note. + = positive association; - = negative association.

While the initial model assumes there could be both negative and positive associations between flow and burnout symptoms, the adjusted model assumes mainly negative relationships. Nevertheless, some studies (n = 2) found that enhanced flow experience (or facets of flow) is associated with more severe burnout symptoms, and there were partly non-significant results. This indicates that the findings should not yet be interpreted as final and that both possible mechanisms of action should continue to be considered in the future. The assumption of a bidirectional association can be maintained as there is evidence that flow is protective of burnout symptoms and that individuals suffering from burnout symptoms may experience less flow. The resulting model is an extension of the Transactional Model of Stress and Flow (Peifer, 2012; Peifer & Tan, 2021) and can also be linked to the assumptions of the Job Demands-Resources Model (J-DR) introduced by Demerouti et al. (2001). Among others, the extended J-DR model (Bakker & Demerouti, 2017) postulates a negative association between motivation and strain. Work engagement, a construct closely related to flow (Langelaan et al., 2006; Lovelace et al., 2007), is assigned to the motivation dimension. Moreover, exhaustion is assigned to strain in this model.

Accordingly, our main finding of a negative relationship between flow and burnout symptoms can be reconciled with the predictions of the J-DR model.

Further studies should investigate the relationship between flow and burnout symptoms. These studies should consider the various sub-dimensions of burnout and the facets of flow as our review indicates that these facets and sub-dimensions may be related to each other in different ways. Only when both constructs are broken down appropriately the underlying mechanisms of action can be fully understood. Therefore, future studies should use validated and commonly used instruments to measure flow and burnout symptoms. We recommend using the WOLF (Bakker, 2008) to measure flow. It is a validated instrument specifically adapted to the work context in which burnout symptoms occur and considers different facets of the flow experience. Also, the Flow Frequency Scale (Bartzik, Aust, & Peifer, 2021; Bartzik, Bentrup, et al., 2021) is recommended as this instrument addresses three facets of flow – absorption, perceived demands-skill balance, and enjoyment – that integrate the competing operationalizations of flow (Peifer & Engeser, 2021). This measurement instrument focuses on the frequency of flow experience and contains one item eliciting whether all three components of the flow occurred simultaneously. We also recommend using the MBI-GS (Schaufeli et al., 1996) to measure burnout symptoms as the WHO uses the basis of this questionnaire in the definition for the ICD-11 categorization. Furthermore, the newly developed Burnout Assessment Tool (Schaufeli et al., 2020) could be used in future research as it covers more aspects of the burnout syndrome and takes account of recent findings regarding the conceptualization of burnout. Combining these instruments would allow accurate conclusions to be drawn about the interrelationships between different flow facets and the burnout sub-dimension, thus providing a sound basis for further scientific research. In the process, sum scores should also be formed in each case to check whether the total values are also interrelated.

In addition, it seems worthwhile to develop long-term study designs that examine the relationship between flow and burnout symptoms over several years. In this way, it would be possible to investigate whether any short-term positive effects of the flow experience can also have negative consequences over time. To date, no study has been found that considers such long periods, so the review reveals a gap in

research. Furthermore, experimental settings (e.g., intervention studies) could be used to investigate the relationship between flow and burnout symptoms in more detail.

5.6.6 Limitations and Implications for Future Research

When looking at the studies included in our review, the heterogeneity of the operationalization is noticeable regarding flow experience and burnout symptoms, which, in combination with the small number of studies, makes it difficult to identify a pattern and should therefore be taken into account when interpreting the results.

If the measurement methods used for flow experience are compared, two tendencies emerge that indicate the variability of the operationalization of the construct. First, individual authors have adapted and shortened existing measurement instruments without validating them. Secondly, the core of flow experience is also interpreted differently in different measurement instruments. While the primary contents of the WOLF are absorption, intrinsic motivation, and enjoyment (Bakker, 2008), the flow experience at work scale (Forest et al., 2005) focuses on concentration and control regarding professional tasks. It is therefore debatable whether the measurement instruments actually capture the same construct.

Concerning the burnout construct, this could be due to its different interpretations. Those authors who hold the view that burnout symptoms should be operationalized in terms of a multidimensional concept are opposed by the view that emotional exhaustion as a core component is a sufficient indicator of burnout symptoms (Mosing et al., 2018) and that the decoupling of these individual sub-dimensions from the remaining burnout components is permissible. As this reasoning is frequently found in the literature, studies were also included that only recorded emotional exhaustion. This may have further increased the heterogeneity in the level of associations. The inconsistency of measurement not only reflects the lack of scientific consensus on the definition of burnout symptoms (Demerouti et al., 2003; Rotenstein et al., 2018) but also points to the limited comparability of the results.

Another limitation is that some studies in the systematic review have not previously hypothesized the relationship between flow and burnout symptoms. The correlations reported are more likely to have

arisen as by-products when, for example, correlation tables were reported across all constructs measured. Furthermore, the associations between flow and burnout symptoms are in some studies described in more complex analysis models. In these models, the simple connections between flow and burnout symptoms are not presented; they are influenced by other factors. This could distort the results. With the proposed Flow-Burnout-Model, the foundation for hypothesis-driven research is now laid, and future research can be conducted on this basis.

5.7 Conclusions

Overall, the systematic review constitutes an advance in the research on flow and burnout symptoms. The increasing prevalence of burnout symptoms underlines that the search for protective factors is essential. Through the theoretical derivation of a model linking the flow experience and burnout symptoms, associations and underlying mechanisms could be described, and possible effects of the two constructs on each other could be demonstrated.

Furthermore, the systematic review can provide an overview of the relationships between flow and burnout symptoms. Through the review, it becomes clear that the different facets of flow and the sub-dimensions of burnout are related to each other in different ways. This leads to the recommendation that in future research, these facets and sub-dimensions should be explicitly taken into account to be able to comprehend the individual associations even better. Moreover, other contributory factors should be considered (e.g., recreation, cultural differences, effects of time) as different studies reported various influential factors.

The mainly negative associations found between flow and burnout symptoms in this review play a crucial role in both research and practice. On the one hand, the Flow-Burnout-Model can be used to develop new questions for research and thus expand research into protective factors against burnout. On the other hand, based on our results, flow-promoting interventions at work could be designed for practice as they are negatively associated with burnout symptoms. The positive consequences that would accompany flow (e.g., less emotional exhaustion) could have a positive impact on both employees and employers.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/ijerph19073865/s1, Table S1: Rating using an adapted version of the Newcastle-Ottawa Quality Assessment Scale (adapted from Rotenstein et al., 2018); Table S2: Additional multifactorial results. (see also Appendix B in the present dissertation)

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6 Study III: Keep up the flow: Investigating the relationship between burnout symptoms and flow experience and its psychophysiological basis

Reference: **Aust, F.,** Peifer, C., Handschuch, K., Rothe, N., Walther, A., Penz, M., Eder, J. & Wekenborg, M. K. (under review). Keep up the flow: Investigating the relationship between burnout symptoms and flow experience and its psychophysiological basis.

Only minor formatting changes have been made, e.g., to the font, tables, citation style, presentation of statistics, or figures, in order to achieve a consistent formatting style throughout this thesis.

6.1 Abstract

The research so far suggests a negative association between flow and burnout symptoms. However, studies in this field are rare and the potential underlying psychophysiological associations have hardly been considered. The aim of the present study was two-fold. First, we examined the association between flow frequency and burnout symptoms both cross-sectionally and longitudinally. Thus, we investigated the value of burnout symptoms, measured in 2018, in predicting flow in 2021. Second, we investigated if physiological markers of chronic stress associated with burnout symptoms are also related to flow. More specifically, we examined associations between vagally-mediated heart-rate variability and hair cortisol concentration with flow. Partial correlation analyses served to identify significant cross-sectional negative correlations between burnout symptoms and flow. With the help of multiple regressions, it was shown that burnout symptoms from 2018 negatively predicted flow experience about three years later. No potential associations between physiological markers of chronic stress and flow were found either cross-sectional or longitudinally. The present study provides further evidence for a negative association between burnout symptoms and flow. Hence, our results suggest that individuals with more severe burnout symptoms experience less flow in their working lives even years later. This finding may indicate that more severe burnout symptoms impede people from seeking out situations potentially conducive to flow. As we were unable to test whether flow longitudinally predicts burnout symptoms, reciprocal effects are also possible. Thus, fewer burnout symptoms could lead to more flow, which in turn would promote well-being and make burnout symptoms less likely.

Keywords: burnout symptoms; flow experience; physiological markers of chronic stress

6.2 Introduction

In industrialized societies, the focus in the work environment is often on performance. In recent years, this has led to an increase in stress-related illnesses (Lohmann-Haislah, 2012; Techniker Krankenkasse, 2021) which are a burden for both employees and organizations. The burnout syndrome, described as a state of exhaustion due to chronic working stress (Maslach et al., 2001), has attracted increasing attention. The individual (severe mental illnesses; cardiovascular diseases; Hakanen & Schaufeli, 2012; Melamed et al., 2006) and societal (high sickness rate and occupational disability; AOK-Bundesverband und Wissenschaftliches Institut der AOK [WIdO], 2018) consequences of the burnout syndrome are substantial. One rarely studied consequence of burnout symptoms is the reduced experience of flow. In this study, we wanted to investigate this relationship in more detail and examine how long-lasting the detrimental effect of burnout symptoms on flow experience is, since longitudinal studies are scarce and only examined shorter intervals (Mäkikangas et al., 2010; Rodríguez-Sánchez, Schaufeli, et al., 2011).

Flow is a rewarding state in which individuals feel fully absorbed in a task and have a feeling of natural course of action (Csíkszentmihályi, 1975). Previous work indicates that this high level of concentration and the feeling of control associated with flow enhance performance in different contexts, i.e., work or learning (Barthelmäs & Keller, 2021; Christandl et al., 2018; Demerouti, 2006; Engeser & Rheinberg, 2008; Rijavec et al., 2017). Flow has moreover been positively associated with well-being (Bassi et al., 2014; Rijavec et al., 2017; Rivkin et al., 2018) and also negatively associated with burnout symptoms (for an overview see Aust et al., 2022; Mosing et al., 2018). In addition, flow is associated with moderate physiological arousal (Peifer et al., 2014) and has been described as a "powerful sustainer of coping" (Lazarus et al., 1980, p. 209). A Flow-Burnout-Model was recently proposed (Aust et al., 2022) describing the relationship between flow and burnout symptoms and presenting potential underlying mechanisms. The model draws on the Transactional Model of Stress and Flow (Peifer & Tan, 2021). Briefly, the Flow-Burnout-Model states that individuals' subjective appraisals of demands and their personal resources give rise to distinct patterns of physiological arousal, accompanied by varying subjective experiences. Flow is hence experienced when the perceived demands align with the perceived resources bringing along a state of moderate arousal. Flow is thereby distinct from the subjective

experience of acute stress (demands exceed resources, high physiological arousal) and relaxation (resources exceed demands, low physiological arousal). As an addition to the Transactional Model of Stress and Flow, the Flow-Burnout-Model postulates that these three subjective experiences are related to burnout symptoms in different ways. Flow and relaxation are negatively associated with burnout symptoms while acute stress is positively associated with burnout symptoms. In a systematic review designed to test the predictions of the Flow-Burnout-Model, it was found that studies so far report a negative relationship between flow and burnout symptoms both in cross-sectional and longitudinal designs (Aust et al., 2022). However, some studies found no associations or even positive associations. Different operationalizations of the two constructs as well as methodological shortcomings (e.g., homogenous sample, cross-sectional data, insufficient consideration of the sub-dimensions of burnout, insufficient operationalization of flow, for an overview see Aust et al., 2022) may have affected the results and more studies are needed to investigate this relationship cross-sectionally and longitudinally. We address these issues by using a large and heterogenous sample and taking into account both the sub-dimensions of burnout and the various facets of flow. In addition, we scrutinize both cross-sectional and longitudinal data and take account of important cofounders (e.g., depression). Moreover, we investigate associations with physiological markers of chronic stress as these relationships were theoretically derived within the framework of the Flow-Burnout-Model and have not yet been empirically tested (Aust et al., 2022). In our first approach, we investigate whether physiological markers of chronic stress associated with burnout symptoms (Penz et al., 2018; Wekenborg, Schwerdtfeger, Rothe, et al., 2022) are also related to flow experience. If both constructs are associated with the physiological markers of chronic stress, this may indicate an underlying psychophysiological mechanism that could be investigated in future research. Therefore, this study aims (1) to examine the relationship between burnout symptoms and flow (cross-sectional and longitudinal) and (2) to investigate the relationship between burnout associated physiological markers of chronic stress and flow.

6.3 Background

6.3.1 Flow and Burnout Symptoms

Flow refers to a state experienced as pleasant, in which individuals can concentrate completely on the task at hand. The perceived demands are in balance with the skills, the passage of time is forgotten, and the activity is intrinsically rewarding (Csíkszentmihályi, 1975; Csíkszentmihályi & Csíkszentmihályi, 1988). Flow can be experienced in leisure time but more often it is described in the work context (Csíkszentmihályi & LeFevre, 1989). Peifer and Engeser (2021) assume three core elements that constitute the flow experience: absorption, perceived demand-skill balance, and enjoyment. Barthelmäs and Keller (2021) claim that flow experience can have consequences on the affective, cognitive, and physiological level as well as on performance. Many studies have confirmed the positive association between flow experience and performance aspects – for example with in-role and extra-role performance (Demerouti, 2006), results in exams (Engeser & Rheinberg, 2008) or academic achievement (Rijavec et al., 2017). Moreover, flow is associated with life satisfaction, hedonic balance, psychological well-being (Bassi et al., 2014), lower ego depletion, decreased need for recovery, work engagement and subjective vitality (Rivkin et al., 2018).

Few studies have investigated the relationship between burnout symptoms and flow. According to Maslach et al. (2001), the burnout syndrome is composed of three core symptoms: increased levels of emotional exhaustion, cynical attitudes towards work, and reduced personal accomplishment. This definition is the basis for the classification of burnout symptoms as an occupational phenomenon in the ICD-11 (World Health Organization, 2020). The Maslach Burnout Inventory (MBI; Maslach & Jackson, 1981) is currently considered the gold standard for assessing burnout within the research field (e.g., Schaufeli et al., 2020).

According to the Transactional Model of Stress and Flow (Peifer & Tan, 2021) an individual's subjective evaluation of their coping resources (e.g., skills and needs) in demanding situations plays a crucial role in determining whether they experience stress or flow. Perceiving coping resources as insufficient leads to subjective stress, whereas a sense of sufficient coping resources results in the experience of flow.

Individuals suffering from burnout symptoms, and who, according to the definition, have a lack of motivation and energy, and a feeling of reduced personal performance (Bianchi et al., 2015; Maslach et al., 2001), may accordingly assess potentially stressful situations as unmanageable more often and consequently experience stress instead of flow. Research findings support this notion, indicating that individuals with burnout symptoms tend to exhibit negative patterns of interpretation (Bianchi & Da Silva Nogueira, 2019). Indeed, more severe burnout symptoms have been associated with more severe subjective feelings of stress (Wekenborg et al., 2019) and higher anxiety (Jönsson et al., 2015). In a systematic review by Aust et al. (2022), most of the 13 cross-sectional studies included found a negative association between flow and burnout symptoms, which supports the assumptions of the Transactional Model of Stress and Flow mentioned above. For example, Ljubin-Golub et al. (2020) reported negative associations between burnout symptoms and various flow facets (absorption, enjoyment and intrinsic motivation) in university students. Mosing et al. (2018) focused on emotional exhaustion and found negative associations with flow proneness in various contexts (e.g., work, maintenance). Some other studies also report negative associations between flow and burnout symptoms (Bakker & Geurts, 2004; Lavigne et al., 2012; Schiefele et al., 2013; Xie et al., 2019; Zito et al., 2016). Nevertheless, a positive association between burnout symptoms and flow was also found (Kasa & Hassan, 2016), likewise a positive association between burnout symptoms and the flow facet absorption (Baumgarten et al., 2020).

Since the studies examining the relationship between flow and burnout symptoms vary methodologically and look at different sub-dimensions of burnout or facets of flow, further research seems necessary to generalize the findings found. For example, the sub-dimension emotional exhaustion was examined the most, whereas the dimensions of cynical attitudes towards work and reduced personal accomplishment were considered less frequently. For flow experience, the enjoyment facet seems to show a particularly stable negative correlation with burnout symptoms. Regarding the facets absorption and intrinsic motivation, the findings were more heterogeneous (for an overview see Aust et al., 2022). Therefore, we want to examine the relationship between flow and burnout symptoms on various levels. Hence, we consider the relationships for both the total scores on burnout symptoms and flow as well as the individual sub-dimensions of burnout (emotional exhaustion, cynical attitudes toward work and

reduced personal accomplishment) and the facets of flow (absorption, perceived demand-skill balance and enjoyment). Moreover, like some other studies (e.g., Kasa & Hassan, 2015; Mäkikangas et al., 2010), we used a frequency scale and asked participants how often they had experienced flow in the last two weeks at work (Flow Frequency Scale of Bartzik and Peifer (2023) see Appendix C – Table A6.1).

With regard to the existing literature, we suggest that *there is a negative cross-sectional relationship between the frequency of flow experience and burnout symptoms (Hypothesis 1).*

In the systematic review by Aust et al. (2022), it is postulated that flow and burnout symptoms may also influence each other over time. As described above, the negative interpretive patterns associated with burnout symptoms (Bianchi & Da Silva Nogueira, 2019), as well as feelings of exhaustion and lack of energy, may interfere with the subjective experience of flow. The absence of flow impairs the development of personal resources (e.g., Salanova et al., 2006) which are essential to reduce burnout symptoms (e.g., Contreras et al., 2020; Schwarzer & Hallum, 2008). When the buildup of personal resources is impaired by lack of flow, this may sustain burnout symptoms. In other words, a downward spiral could occur that reduces flow experience in the long run and maintains burnout symptoms.

To the best of our knowledge there are only five studies with a longitudinal design investigating the association between flow and burnout symptoms (see Aust et al., 2022). Two were diary studies over a few days (Demerouti et al., 2012; Xanthopoulou et al., 2018), one study used the Experience Sampling Method (ESM) over 14 days (Rodríguez-Sánchez, Schaufeli, et al., 2011), and the other studies used intervals between measurement time points of no more than six months (Lavigne et al., 2012; Mäkikangas et al., 2010). The present study is therefore the first to examine the relationship between burnout symptoms and flow over a period of about three years.

Some of the longitudinal studies considered the relationship between flow and burnout symptoms in the context of more complex models with other influencing variables (e.g., Lavigne et al., 2012; Xanthopoulou et al., 2018). Moreover, some studies examined longitudinal associations. Demerouti et al. (2012) investigated the predictive effect of flow on burnout symptoms. They found that enjoyment at work negatively predicted emotional exhaustion at work and at home/bedtime. One study considered the reverse effect of burnout symptoms on flow experience (Mäkikangas et al., 2010). They found a

negative association between the initial level of burnout symptoms with the initial level of flow experience, but burnout symptoms did not predict changes in flow experience. Moreover, burnout symptoms were negatively correlated with flow surveyed respectively six and 12 weeks later. Rodríguez-Sánchez, Schaufeli, et al. (2011) found in their study using an ESM that healthy individuals experience higher levels of flow than do burned-out individuals. In our research we want to confirm the results indicating an inhibiting effect of burnout symptoms on flow experience.

Therefore, we hypothesize that *there is a negative longitudinal effect of burnout symptoms on the frequency of flow experience (Hypothesis 2).*

6.3.2 Flow and Physiological Stress Marker

Aust et al. (2022) suggested that different activations in the two main stress-related psychophysiological systems (i.e., the hypothalamus-pituitary-adrenal [HPA]-axis, the autonomic nervous system [ANS]) are relevant for burnout symptoms and flow, and may, at least partly, explain the relationship between these two constructs. However, these assumptions have not yet been empirically investigated but could provide important indications of the physiological mechanisms involved.

Indicators of the activity level of the two systems mainly responsible for the regulation of physiological stress reactivity appear, besides inflammatory markers (Gouin et al., 2012) or metabolic hormones (Lee et al., 2015), to be particularly suitable markers in this context as they have previously been associated with flow (e.g., Peifer et al., 2014; Tozman et al., 2017).

With respect to objective markers of chronic stress, hair cortisol (HCC) and hair cortisone concentrations (HCN) are validated markers of the HPA-axis (Stalder et al., 2017), whereas high-frequency (HF) changes in the timing of heart beats (heart rate variability) is a validated indicator or the parasympathetic branch of the ANS (Thayer et al., 2012).

Briefly, cortisol is released under acute stress. This cortisol is stored cumulatively in the hair. Due to the natural growth rate of the hair (approx. 1cm/month), the accumulated stress can be determined retrospectively in the form of HCC (E. Russell et al., 2012; Stalder et al., 2017). The method is considered valid with high intraindividual stability (Penz et al., 2018; for an overview see Stalder et al.,

2017). The HCN should also be examined as there is evidence that it has explanatory value beyond the HCC (Stalder et al., 2013).

Vagally-mediated heart rate variability (vmHRV) appears to be an especially relevant marker reflecting the parasympathetic activation of the ANS. While heart rate variability (HRV) reflects an interplay between the sympathetic nervous system (SNS) and the parasympathetic nervous system (PNS) only the PNS is a modulator of the heart rate on a time scale of milliseconds (Berntson et al., 1997; Kuo et al., 2005; Saul, 1990). Therefore, the HF-changes in HRV can be considered a relatively pure measurement of vagal function (see Wekenborg, Schwerdtfeger, Rothe, et al., 2022). Moreover, measured in a resting state, vmHRV can be considered a relatively stable trait-like marker (Bertsch et al., 2012) and can therefore be interpreted as a physiological marker for chronic stress.

Multiple studies have shown that burnout symptoms are associated with these physiological markers of chronic stress (Penz et al., 2018; Wekenborg, Schwerdtfeger, Rothe, et al., 2022; Wekenborg et al., 2019). One of these found that individuals suffering from burnout symptoms tend to have increased overall HCC (Penz et al., 2018), suggesting a hyperactive HPA axis (Wendsche et al., 2020). Moreover, studies have already shown that vmHRV is significantly negatively associated with burnout symptoms (Kanthak et al., 2017; Wekenborg et al., 2019) and that low vmHRV can lead to more severe emotional exhaustion even years later (Wekenborg, Schwerdtfeger, Rothe, et al., 2022).

For flow experience, associations with different acute stress markers have been investigated and yielded heterogeneous findings (for an overview see Khoshnoud et al., 2020 and Peifer et al., 2022), but so far, we are not aware of any studies on the physiological markers of chronic stress, which is another research gap we hope to bridge.

To investigate the relationship between physiological arousal and flow, various experimental studies have used salivary cortisol as a parameter for acute stress (Keller et al., 2011; Peifer et al., 2014; Tozman et al., 2017). Keller et al. (2011) found that during a condition of skill-demands balance, a condition in which flow experience often occurs, cortisol levels were higher than in a boredom condition. By contrast, Tozman et al. (2017) and Peifer et al. (2014) found an inverted u-shaped relationship between cortisol and the flow facet absorption. Participants with a moderate cortisol level had the highest

absorption values compared to participants with low or high cortisol levels in these studies. Moreover, it was shown that experimentally manipulated very high cortisol levels (20mg Hydrocortison) affected flow experience negatively (Peifer et al., 2015).

We assume that there may also be associations of frequency of flow experience and HCC in line with the previously found associations with acute stress parameters. Peifer et al. (2014) pointed out that flow should be accompanied by moderate arousal as it is referred to as a state between boredom and stress (Csíkszentmihályi, 1975; Peifer et al., 2014; Rheinberg & Engeser, 2018). The explanation for this assumption could also be extrapolated from the acute stress state to chronic stress parameters (i.e., HCC, HCN). Individuals experiencing a lot of stress over a long period of time (which could lead to burnout symptoms) should exhibit increased HCC (Lee et al., 2015). However, a state of severe stress is not compatible with flow experience (Peifer & Tan, 2021). Therefore, high HCC could be associated with less frequent flow. Individuals with very low HCC may more often experience situations of boredom and less frequent flow. The most frequent flow experience should be experienced by individuals experiencing both stress-relevant phases but also experiencing recovery. Their HCC should be within a moderate range.

We hypothesize that *there is an inverted u-shaped relationship between chronic stress (described by hair cortisol and hair cortisone) and the frequency of flow experience (Hypothesis 3).*

Some studies have examined the relationship between flow and acute stress using parameters reflecting ANS responses (for an overview see Khoshnoud et al., 2020 and Peifer et al., 2022). However, the results regarding the relationship with flow were ambiguous and dependent on the task performed.

For example, decreased levels of the Root Mean Square of Successive Differences (RMSSD), a parameter reflecting vmHRV, were associated with fit condition compared to boredom condition (Keller et al., 2011), indicating that reduced vmHRV accompanies more flow experience. For the HF-HRV the evidence is mixed. Apart from positive linear associations with absorption (Peifer et al., 2014) it was also found that HF-HRV decreases in a condition of optimal challenge (typical for flow) compared to baseline (Kozhevnikov et al., 2018). Moreover, in another study the lowest HF-HRV values were observed in a condition of matching demands and skills (typical of flow) compared to easy and hard

conditions (Harris et al., 2017). Other studies found inverted u-shaped relationships between HF-HRV and flow (Bian et al., 2016; Chin & Kales, 2019; Tozman et al., 2015).

These studies investigated the relationship between flow and the reactivity of the cardiac vagal tone (Laborde et al., 2018). Since earlier studies reported very different associations between flow and vmHRV focusing on the reactivity of the PNS, we seek to examine if there is a clearer association between vmHRV in resting state, which is a relatively stable marker (Bertsch et al., 2012), and flow frequency. The vmHRV can be used as an indicator of the adaptability of the individual to the respective conditions. In this context, high variability reflects increased flexibility of neurovisceral integration, which enables a flexible and appropriate response to respective situations (Thayer & Lane, 2009). Peifer and Tan (2021) postulate that flow experience is characterized, among other things, by optimal physiological activation. Accordingly, high vmHRV could lead individuals to activate appropriately for the situation, which may promote flow. This would corroborate the fact that greater resting vmHRV is associated with various positive outcomes, e.g., better performance in executive-function tasks (Thayer et al., 2009). These, in turn, are outcomes also related to flow (Christandl et al., 2018; Engeser & Rheinberg, 2008). Therefore, we propose that this physiological marker could be a further underlying mechanism explaining the association between flow and burnout symptoms. We assume an inverse relationship between flow and vmHRV compared with burnout symptoms. The adaptability of the organism to the specific situation could thereby play a decisive role. While low adaptability, indicated by low vmHRV, positively predicted future burnout symptoms (Wekenborg, Schwerdtfeger, Rothe, et al., 2022), the reverse effect can be assumed for flow.

We hypothesize that *high vagal tone has a positive effect on the frequency of flow experience (Hypothesis 4).*

Nevertheless, not to leave heterogeneous results regarding the relationships between acute vmHRV parameters and flow unaddressed, we look at other possible relationships exploratively (i.e., quadratic relationships).

6.4 Methods

This study was preregistered at OSF[1] (https://doi.org/10.17605/OSF.IO/NMWC4). The study has been developed in accordance with the Declaration of Helsinki, and has been approved by the local ethics committee of the Technical University Dresden.

6.4.1 Sample

Data collection in this study was conducted within the Dresden Burnout Study (DBS). On the one hand, questionnaire and vmHRV data collected as part of a previous survey wave of the DBS in 2018 were used (t_0). On the other hand, questionnaire data and hair samples were collected in 2021 (t_1). At t_0 flow was not considered. Participants were registered for the DBS, an annual cohort study which collects survey data as well as biomarkers to explore the burnout phenomenon on a psychological and physiological level. Subjects who had given their consent to be contacted for other studies were invited by e-mail to participate in this study. The design of the present study was approved by the local ethics committee and conducted in accordance with the Declaration of Helsinki.

Inclusion criteria were age between 18 and 68 years and sufficient language skills to fill out a questionnaire in German. In spring 2021 (t_1), 819 subjects completed at least the flow questionnaire and the Maslach Burnout Inventory - General Survey (MBI-GS; Schaufeli et al., 1996) of the online questionnaire. The participants of the core sample (at least flow and MBI-GS at t_1) were 537 females and 282 males with a mean age of 48.36 (SD = 10.04)[2] ranging from 21 to 67. The participants were also invited to send a hair sample by mail for a physiological stress marker determination. In total 440 samples were analyzed.

To test the longitudinal hypotheses, we used existing data from the DBS. MBI-GS and vmHRV data were collected in fall 2018 (t_0).

[1] For reasons of economy, we refrained from conducting preregistered mediation analyses for the present study. In addition, we used the MBI-GS values in 2018 and not, as preregistered, from 2020 so that all longitudinal data (questionnaires and HRV) were uniformly taken from the same sample.

[2] For some subjects, the date of birth was available from another survey wave and the age information in this study was thus validated and, if necessary, adjusted.

To test our hypotheses, we only used the data of participants who were employed at t_1 as we wanted to assess flow at work. Participants who were not employed at t_0 (n = 9) rated their burnout symptoms related to their last job.

Due to the voluntary provision of hair samples, dropouts and the exclusion of outliers (> 2.5 SD) from the study variables, the sample size varies for the different analysis (pairwise deletion, available case approach).

6.4.2 Procedure

Participants filled out the online questionnaire on the study homepage (www.dresdner-burnout-studie.de) using a personalized login. After completing the questionnaires, participants were asked if they wanted to submit hair samples for physiological stress marker determination. If they agreed to send in hair samples, they had the options of (1) receiving the return prepaid document via mail or (2) receiving the documents via e-mail and sending us the sample at their own expense.

6.4.3 Self-reported Measures

Flow experience at work was measured at t_1 with the Flow Frequency Scale (Bartzik, Aust, & Peifer, 2021; Bartzik & Peifer, 2023) Participants were asked to remember the last two weeks at work and to rate nine items on a 6-point rating scale ("How often have you experienced in the last two weeks at work that…"; 1 = *never* to 6 = *[almost] always*). The nine items were used to calculate the total score. There are three subscales with three items each, named – *perceived demand-skill balance* (e. g., "…you could use your skills to an optimal extent."), *absorption* (e. g., "…you were completely absorbed in an activity") and *enjoyment* (e. g., "…you could enjoy what you were doing"). Cronbach's α for the scale was .95. The Cronbach's α for the subscales were .91, .82, and .93. The questionnaire can be found in the Appendix C – Table A6.1.

Burnout symptoms were assessed with the German version of the Maslach-Burnout Inventory - General Survey (MBI-GS-D, Büssing & Glaser, 1999; MBI-GS, Schaufeli et al., 1996). The scale consists of 16 items aggregated to a total score (MBI-GS total score; Cronbach's α = .91 [t_0 and t_1]) using the weighted MBI-GS total score introduced by Kalimo et al. (2003). Three subscales – *emotional*

exhaustion (e.g., "I feel used up at the end of the workday"; Cronbach's α = .92 [t_0], .91 [t_1]), *reduced personal accomplishment* (e.g., "In my opinion, I am good at my job" [recoded]; Cronbach's α = .84 [t_0 and t_1]) and *cynical attitudes toward work* (e.g., "I have become less enthusiastic about my work"; Cronbach's α = .88 [t_0], .84 [t_1]) were calculated additionally. The items are rated on a 7-point rating scale from 0 = *never* to 6 = *daily*.

Control variables. We collected demographic and health-related information that were previously associated with the relevant variables as control variables: age, sex, hair coloring (all at t_1), smoking status, alcohol consumption, and Body Mass Index [BMI] (all at t_0) (Hayano et al., 1990; Karason et al., 1999; Rossy & Thayer, 1998; Thayer et al., 2006). We also measured depressivity with the German version (PHQ-9-D; Löwe et al., 2002) of the Patient Health Questionnaire (PHQ-9; Kroenke et al., 2001), which had a Cronbach's α of .87 (t_0) and .86 (t_1) as it depicts relevant overlap with burnout symptoms (Bianchi et al., 2015).

6.4.4 Physiological Measures

Cortisol/cortisone

In order to measure HCC and HCN participants were asked to send us hair strands (~3mm diameter) close to the scalp from a posterior vertex position. Hair segments of 3 cm were analyzed to ascertain the integrated cortisol secretion over the last three months prior to the hair-sampling (Stalder & Kirschbaum, 2012). Liquid chromatography and tandem mass spectrometry were used to determine the cortisol and cortisone levels. Detailed information on the analytical protocol is provided elsewhere (Gao et al., 2013).

RMSSD and HF

The collection and processing of HRV data has been described elsewhere (Wekenborg, Schwerdtfeger, Rothe, et al., 2022). Briefly, a wireless chest transmitter and a wrist monitor recorder (Polar RS800CX system; Polar Electro OY, Kempele, Finland) were used to measure HRV. Participants were in a seated resting condition, as this is suitable for recording HRV as a trait-like marker (Bertsch et al., 2012) and a time span of about 5.5 min was used to calculate the parameters. The company NEUROCOR Ltd. & Co. KG (Trier, Germany) analyzed the raw data by correcting for artifacts and calculating RMSSD and

HF-HRV. Both indicators for vmHRV were then log transformed to reduce skewness (Laborde et al., 2017).

6.4.5 Data Analysis

Data were analyzed with the IBM SPSS statistics package V28. Outliers on relevant study variables were excluded (> 2.5 SD). To test Hypothesis 1, we computed partial correlations including the MBI-GS total score, the flow total score, the MBI-GS sub-dimensions, and the facets of flow (all t_1) controlling as preregistered for age and sex (t_1). To test Hypothesis 2, we computed a two-step hierarchical regression. Therefore, we used the flow total score at t_1 as dependent variable. We entered the control variables as predictors to check if age and sex (t_1) were associated with the flow total score (baseline model). Afterwards, we entered the MBI-GS total score at t_0 as a predictor (model 1).

To test Hypothesis 3, we conducted a three-step hierarchical regression with the flow total score at t_1 as dependent variable. Again, we used age and sex (t_1) as control variables. As hair coloring (t_1) had a significant correlation with HCN in this study, we added this variable as a control variable (baseline model). In a second step, we entered HCC as independent variable in the model to test for a linear effect. In a third step, we added the squared values of HCC as predictor to test the predicted inverted u-shape relationship (model 2). The same procedure was conducted for HCN (model 3).

Hypothesis 4 was tested with another two-step hierarchical regression with the flow total score as dependent variable. This time age, sex, smoking status, alcohol consumption, and BMI were entered into the model as control variables as in earlier research they were associated with HRV measurements (Hayano et al., 1990; Karason et al., 1999; Rossy & Thayer, 1998; Thayer et al., 2006). In a second step, we entered the logarithmized RMSSD (lnRMSSD) into the model as independent variable (model 4). This procedure was used to test the prediction with logarithmized HF-HRV (lnHF-HRV) as well (model 5).

The results of the regressions (models 1-5) were checked using bootstrapping (5,000 samples) to generate more robust standard errors and confidence intervals and counteract deviations from the normal distribution.

Exploratory analysis

Additional analyses were exploratorily conducted. They were not preregistered. As earlier studies have suggested a strong connection between burnout symptoms and depression (Bianchi et al., 2015; Schonfeld & Bianchi, 2016), we additionally conducted the analyses for Hypotheses 1 and 2 with depression (PHQ-9) as another control variable. Our study also showed a high correlation of r = .76 (t_0) and r = .70 (t_1) between the MBI total score and the PHQ-9, supporting this approach. Detailed information regarding the correlations with each sub-dimension is presented in Appendix C – Table A6.2. Furthermore, we conducted separate two-step hierarchical regressions with the flow facets (perceived demand-skill balance, absorption, enjoyment) as dependent variables. In addition, the three sub-dimensions of the MBI-GS (emotional exhaustion, reduced personal accomplishment and cynical attitudes towards work at t_0) were used in the various regression models as predictors (instead of the MBI-GS total score) to analyze the impact of the three sub-dimensions of the MBI-GS on the total score for flow and also its facets.

We also checked if there were u-shaped relationships between flow and vmHRV by including the squared terms of lnRMSSD or lnHF-HRV in the regression models. Again, in further hierarchical regressions we used the facets of flow as independent variables predicted by the different physiological markers of chronic stress.

The regression models were also checked by bootstrapping (5,000 samples).

6.5 Results

6.5.1 Descriptive Results

Means and standard deviations for flow experience (t_1) and the MBI-GS (t_0 and t_1) are presented in Table 6.1, likewise an overview of the physiological markers of chronic stress and the control variables used in this study. Intercorrelations are presented in the Appendix C – Table A6.2. With regard to the MBI-GS (total score, emotional exhaustion, and cynical attitudes towards work), there was a slight descriptive increase between t_0 and t_1. At both measurement points, the highest values were obtained for the sub-dimension emotional exhaustion. The sub-dimension reduced personal accomplishment had the lowest

values at both measurement points. With regard to flow experience, descriptive evidence shows that the mean values of the total score and the facets were equally high and slightly above the scale mean.

Table 6.1 *Means and standard deviations of study variables*

Variable	Measurement point t_0			Measurement point t_1		
	N	Value	Range	N	Value	Range
Control Variables						
Age, y, *M (SD)*				819	48.36 (10.04)	21-67
Male, n (%)				819	282 (34.40)	
BMI, kg/m^2, *M (SD)*	212	26.22 (5.04)	17.92-49.18			
Smokers, n (%)	210	20 (9.50)				
Alcohol consumer, n (%)	211	192 (91.00)				
Hair coloring, n (%)				386	126 (32.60)	
Questionnaires						
MBI-GS (total score)	223	2.06 (1.10)	0.00-4.37	817	2.20 (1.09)	0.00-4.96
EE	223	2.63 (1.48)	0.00-5.80	819	2.92 (1.53)	0.00-6.00
RPA	221	1.40 (0.91)	0.00-3.67	807	1.39 (0.91)	0.00-3.83
CY	221	1.90 (1.46)	0.00-5.40	815	2.00 (1.40)	0.00-5.40
Flow (total score)				819	3.74 (1.14)	1.00-6.00
DSB				819	3.73 (1.26)	1.00-6.00
AB				819	3.68 (1.17)	1.00-6.00
EN				819	3.80 (1.25)	1.00-6.00
PHQ-9	217	0.76 (0.51)	0.00-2.11	804	0.86 (0.53)	0.00-2.22
Physiological markers of chronic stress						
HCC (pg/mg)				380	5.13 (5.61)	0.18-38.86
HNC (pg/mg)				378	11.70 (7.98)	0.40-47.25
lnRMSSD (m^2)	209	3.47 (0.58)	1.95-4.98			
lnHF-HRV (m^2)	209	5.60 (1.29)	2.37-8.71			

Note. AB = absorption, BMI = Body Mass Index, CY = cynicism, DSB = perceived demand-skill balance, EE = emotional exhaustion, EN = enjoyment, HCC = hair cortisol concentration, HNC = hair cortisone concentration, MBI-GS = Maslach Burnout Inventory - General Survey, PHQ-9 = Patient Health Questionnaire (9 items), RPA = reduced personal accomplishment.

6.5.2 Hypotheses Testing

To test Hypothesis 1, that there is a negative cross-sectional association between burnout symptoms and frequency of flow experience, we calculated partial correlations. Table 6.2 shows that the flow total score and the MBI-GS total score as well as the facets of flow and the sub-dimensions of the MBI-GS are negatively associated with each other even after adjusting for the effects of age and sex. These results indicate that in a cross-sectional design a more frequent flow experience comes along with lower burnout symptoms. These patterns could be observed for all facets of flow and all sub-dimensions of the MBI-GS. The strongest correlation occurred between the two total scores (r = -.78). The facet enjoyment achieved an equally high correlation with the MBI-GS total score. The various sub-dimensions of the MBI-GS and facets of flow showed similarly strong correlations in the different combinations (r between -.55 and -.68). The results support Hypothesis 1.

Table 6.2 *Cross-sectional partial correlations between flow and burnout symptoms*

Flow	Burnout Symptoms			
	Total score	EE	RPA	CY
Total score	-.78**	-.64**	-.64**	-.67**
DSB	-.70**	-.55**	-.59**	-.60**
AB	-.71**	-.60**	-.58**	-.58**
EN	-.78**	-.63**	-.61**	-.68**

Note. ** p < .001 (one-tailed). Correlations controlled for age and sex. Pairwise deletion was used. EE = emotional exhaustion, CY = cynicism, RPA = reduced personal accomplishment, DSB = perceived demand-skill balance, AB = absorption, EN = enjoyment.

In Hypothesis 2 we postulated a negative longitudinal association between MBI-GS total score (t_0) and flow total score (t_1). The baseline model, consisting of age and sex as predictors (t_1) and frequency of flow as dependent variable did not explain a significant amount of variance (F(2, 220) = 0.11, p = .899). When entering the MBI-GS total score (t_0) as predictor (model 1), the regression model was significant (R^2 = .36, R_{adj}^2 = .35, F(3, 219) = 41.32, p < .001). The MBI-GS total score measured at t_0 significantly negatively predicted frequency of flow experience at t_1 (β = -0.60, t(219) = -11.12, p < .001). These results were confirmed by bootstrap analysis (see Table 6.3) and support Hypothesis 2.

Table 6.3 *Results of the multiple regression with flow total score as dependent variable and MBI-GS total score as predictor (model 1, n = 223)*

Predictor	*b [CI]*	SE_b	β	*t*	*p* (p_{boot})
Age	-0.00 [-0.01, 0.01]	0.01	-0.01	-0.24	.811 (.805)
Sex	0.09 [-0.16, 0.34]	0.13	0.04	0.65	.516 (.488)
MBI-GS total score (t_0)	-0.65 [-0.75, -0.54]	0.05	-0.60	-11.12	< .001 (< .001)

Note. 95% confidence interval (CI) and standard error estimated by BCa-bootstrapping with 5,000 BCa-samples. MBI-GS = Maslach Burnout Inventory - General Survey.

Regarding Hypothesis 3, postulating an inverted u-shaped relationship between HCC or HCN with the frequency of flow experience, we found none of the hypothesized relationships. In both regressions the baseline models (age, sex, hair coloring) were not significant. Adding HCC or HCN as predictors in a second step resulted in non-significant models. Furthermore, entering the squared HCC (model 2) or the squared HCN (model 3) as predictors in the regression did not explain significant variance (HCC: $F(5, 372) = 1.05$, $p = .386$; HCN: $F(5, 370) = 0.93$, $p = .460$). An overview of the coefficients is given in Table A6.3 and Table A6.4 in the Appendix C.

The anticipated positive linear relationship between vmHRV (t_0), indicated with lnRMSSD and lnHF-HRV, and the flow total score (t_1) was not found (Hypothesis 4). Again, the baseline models (age, sex, alcohol consumption, smoking status, BMI) were not significant. Entering lnRMSSD (model 4; $F(6, 200) = 1.43$, $p = .204$) or lnHF-HRV (model 5; $F(6, 200) = 1.37$, $p = .228$) into the regression models did not lead to significant changes. An overview of the coefficients is given in Table A6.5 and Table A6.6 in the Appendix C.

Therefore, Hypotheses 3 and 4 are not supported by the data.

6.5.3 Results of Exploratory Analyses

The partial correlations between the MBI-GS total score, the flow total score, and the various sub-dimensions and facets were still significant after additionally adjusting for depression (PHQ-9). An overview is given in Table A6.7 in the Appendix C.

As explained above, in addition to the preregistered control variables sex and age, we checked exploratorily if depression (t_0) had an influence on the frequency of flow experience (the results are presented in the Appendix C – Table A6.8; only models including all predictors are presented). By analyzing the influence on the flow total score (t_1), the baseline model consisting of age, sex, and PHQ-9 was significant ($F(3, 213) = 26.44$, $p < .001$). PHQ-9 was a significant predictor for the flow total score ($\beta = -0.53$, $t(213) = -8.88$, $p < .001$). Entering the MBI-GS total score (t_0), the PHQ-9 no longer significantly predicted the flow total score. Even with the inclusion of the PHQ-9 as a control variable, the MBI-GS total score was a significant predictor for the flow total score ($\beta = -0.48$, $t(212) = -5.56$, $p < .001$).

Next, we checked whether the same associations were to be found for the facets of flow as outcome variables (absorption, perceived demand-skill balance, enjoyment) as for the total score. Therefore, each flow facet was used in the regression models as dependent variable and hierarchical regressions were performed twice for each facet (in the second model with PHQ-9 as additional control variable). The patterns with respect to the baseline models were confirmed. The models with age and sex as control variables were not significant, whereas the baseline models with PHQ-9 were significant. The MBI-GS total score predicted all three flow facets significantly negatively, even when controlling for depression (see Table A6.9, Table A6.10 and Table A6.11 in the Appendix C).

We moreover analyzed if emotional exhaustion, reduced personal accomplishment and cynical attitudes towards work had different effects on the flow total score and its facets (Table A6.12, Table A6.13, Table A6.14 and Table A6.15 in the Appendix C). All regression models described above were therefore run with the sub-dimensions of the MBI-GS included simultaneously as predictors in the second step of the regression. Again, the patterns for the baseline models were similar to the results reported above.

Emotional exhaustion and reduced personal accomplishment predicted the flow total score significantly negatively. The model was significant (R^2 = .38, R_{adj}^2 = .36, $F(5, 213) = 25.56$, $p < .001$). Cynical attitudes towards work were not a significant predictor. Only reduced personal accomplishment was a significant predictor of the flow total score with PHQ-9 as control variable in the regression model. Emotional exhaustion, however, no longer significantly predicted flow.

Regarding the facets of flow, reduced personal accomplishment and emotional exhaustion significantly predicted all facets of flow, while cynical attitudes towards work only predicted enjoyment. However, when additionally controlling for depression, emotional exhaustion only predicted absorption significantly, but not perceived demand-skill balance and enjoyment. The other results did not change.

No u-shaped relationships were found between vmHRV and flow total score. Furthermore, the analyses with the facets of flow as dependent variables were not significant neither for HCC, HCN, nor for vmHRV.

6.6 Discussion

This study examined the relationship between burnout symptoms and the frequency of flow using cross-sectional and longitudinal analyses. We moreover investigated associations between physiological markers of chronic stress and flow. To do so, we conducted an online survey and participants rated their burnout symptoms and the frequency of their flow experience. They were also asked to send in hair samples in order to analyze their HCC and HCN as endocrine markers of chronic stress. To investigate the longitudinal effects of burnout symptoms on flow we used the data of a survey conducted in 2018. The HRV data from this measurement point were also used to investigate the associations of vmHRV, as a physiological marker of chronic stress (Bertsch et al., 2012), and flow experience.

We found a negative cross-sectional association between burnout symptoms and frequency of flow experience. The total score of these constructs as well as the sub-dimensions of burnout and the facets of flow were negatively correlated. Moreover, the burnout symptoms measured in 2018 predicted the frequency of flow experience in 2021. No associations between flow and physiological markers of chronic stress were found.

6.6.1 Theoretical Implications

6.6.1.1 Relationships between Flow and Burnout Symptoms

The negative cross-sectional associations found between burnout symptoms and frequency of flow support Hypothesis 1. In the systematic review by Aust et al., 2022, 13 cross-sectional studies were included and most of these also found a negative association. Hence, only one study used an MBI-GS total score and a flow total score to investigate the association between burnout symptoms and flow and found a negative association (Xie et al., 2019). Martínez-Zaragoza et al. (2014), using modified total scores, found no association. Our results indicate that there is a negative association between these two constructs. These negative associations seem likely in the light of earlier work examining the relation between flow or burnout symptoms with different outcome variables. While flow is positively related to outcomes like performance or well-being (e.g., Rijavec et al., 2017), burnout symptoms are negatively associated with performance outcomes (Demerouti et al., 2014) and various health variables (e.g., Hakanen & Schaufeli, 2012; Melamed et al., 2006). Moreover, the negative relationship between burnout symptoms and engagement (Schaufeli & Bakker, 2004), a construct related to flow experience (Langelaan et al., 2006; Lovelace et al., 2007), also permits the assumption of a negative relationship (see also Mäkikangas et al., 2010; Rodríguez-Sánchez, Schaufeli, et al., 2011).

We also found a negative effect of burnout symptoms measured in 2018 on the frequency of flow experience in 2021, thereby supporting Hypothesis 2. The MBI-GS total score predicted the total score of flow negatively. Like Mäkikangas et al. (2010), our findings indicate that burnout symptoms may hinder individuals from experiencing flow. In a study using the Experience Sampling Method, Rodríguez-Sánchez, Schaufeli, et al. (2011) also found that individuals suffering from burnout symptoms experienced less flow. In our study, we examined a significantly longer time period and found support for the assumption that burnout symptoms have a negative impact on flow in the long term. These results underline the theoretical assumption of Aust et al. (2022) that people suffering from burnout symptoms are in a depleted state and do not engage in activities in which flow can be experienced.

However, it should be mentioned that in this study the other direction of effect could not be tested as flow was only measured at t_1. Therefore, it will be necessary to consider the reverse effect from flow on burnout symptoms in future studies as research so far gives evidence of this effect, indicating that people experiencing more flow have lower levels of burnout symptoms (Lavigne et al., 2012; Ljubin-Golub et al., 2020).

Overall, the cross-sectional and longitudinal associations found in the present study support the prediction of a potential downward spiral in terms of flow and burnout symptoms based on the Flow-Burnout-Model (Aust et al., 2022). Mechanisms potentially underlying this association, such as a potentially burnout-associated modulation in flow-relevant coping resources, need further empirical investigation.

6.6.1.2 Relationships between Flow Facets and MBI-GS Sub-Dimensions

In addition to the total scores, associations between the various facets of flow and the MBI-GS sub-dimensions should also be discussed.

Cross-sectionally, all flow facets correlated negatively with emotional exhaustion, reduced personal accomplishment, and cynical attitudes towards work. The findings are in line with the results of the systematic review by Aust et al. (2022) as they found that most often significant negative associations appeared between flow and burnout symptoms.

Longitudinally, reduced personal accomplishment was a consistent predictor for burnout symptoms, which is also in line to the findings of the systematic review by Aust et al. (2022). Reduced personal accomplishment predicted both the total flow score and all facets negatively. It is a prerequisite of flow experience that the demands are in balance with the skills (Csíkszentmihályi, 1975; Peifer & Engeser, 2021). Moreover, it is assumed that the balance must be at a high level (see quadrant model; Csíkszentmihályi & Csíkszentmihályi, 1988) or that the perceived demands should even slightly exceed the skills (Baumann et al., 2016). The reduced personal accomplishment could lead to individuals who no longer feel that they have sufficient coping resources and who view their agency as limited. This in turn could lead to less flow, as indicated in the Transactional Model of Stress and Flow (Peifer & Tan,

2021). Another aspect is that self-efficacy is positively related to flow (Salanova et al., 2006). Reduced personal accomplishment and feelings of incompetence (Maslach et al., 2001) could have an opposite effect.

Emotional exhaustion was also a negative predictor for flow experience. This may suggest that exhaustion prevents individuals from seeking out flow-promoting situations (Aust et al., 2022). However, when adding depression as a control variable, emotional exhaustion was no longer a significant predictor in most cases (total score, perceived demand-skill balance, and enjoyment). This can be explained by the fact that emotional exhaustion, as a core element of burnout (Maslach et al., 2001), correlates more strongly with depression than do the other sub-dimensions of burnout (Bianchi et al., 2013). This strong correlation between emotional exhaustion and depression can also be found in our data (see Appendix C – Table A6.2). This may mean that emotional exhaustion is no longer a significant predictor of flow, as certain proportions of variance are explained by depression and no longer by emotional exhaustion (i.e., multicollinearity).

Cynical attitudes towards work were not a significant predictor for flow experience (total score). Moreover, cynical attitudes towards work did not predict neither absorption nor perceived demand-skill balance, but only enjoyment. This could be related to the fact that, in contrast to the other two, this sub-dimension of burnout may not be associated with perceived agency. Emotional exhaustion and the feeling of reduced efficiency could thereby lead to the assessment of the situation as unmanageable, as described above. Cynicism, which rather characterizes a negative attitude toward work, could, however, be associated with the affective component of the flow experience, i.e., enjoyment, but not with absorption and the perceived demand-skill balance. Overall, the results reflect the rather heterogeneous findings in earlier research regarding the association of this sub-dimension with flow. For example, while some studies have found significantly negative associations (Lavigne et al., 2012; Schiefele et al., 2013) others have found no such association (Martínez-Zaragoza et al., 2017) or mixed results (Baumgarten et al., 2020). Rodríguez-Sánchez, Schaufeli, et al. (2011) postulated that cynicism and exhaustion in particular contradict flow experience, characterized by enjoyment and absorption. Our results partially support this assumption in that cynicism negatively affects enjoyment but not

absorption. It should be noted that the bivariate correlations between all sub-dimensions and flow were negative (see Appendix C – Table A6.2). In interaction, the three sub-dimensions seem to partly overlap and thus explain the common variance components. Therefore, individual sub-dimensions no longer contribute significantly to explaining variance in the regression models when all sub-dimensions are taken into account.

In view of the different findings regarding the various facets of flow and the sub-dimensions of burnout, the present study underlines the importance for their consideration in future studies.

6.6.1.3 Relationship between Flow and Physiological Markers of Chronic Stress

None of the hypothesized associations between frequency of flow and the physiological markers of chronic stress hair (cortisol or vagal tone) were found. These results do not support Hypotheses 3 and 4. Thus, while in a specific situation physiological arousal is related to flow experience (Chin & Kales, 2019; Peifer et al., 2014), physiological markers of chronic stress do not seem to be associated with the frequency of flow. While burnout symptoms seem to be related to HCC and vmHRV in a resting position (Penz et al., 2018; Wekenborg, Schwerdtfeger, Rothe, et al., 2022) flow does not.

However, these results can be considered in the context of the findings by Wekenborg et al. (2019). They found that elevated burnout symptoms, especially emotional exhaustion, affect the psychological perception of stress in an acute stressful situation, but not the physiological markers (except the sub-dimension of cynical attitudes towards work). Accordingly, the negative effects of burnout symptoms on flow may not be triggered by the physiological markers, but via an increased subjective perception of stress (Wekenborg et al., 2019) which is not compatible with flow experience as described in the Transactional Model of Stress and Flow (Peifer & Tan, 2021). More specifically, lower vmHRV (trait marker) leads to more burnout symptoms (Wekenborg, Schwerdtfeger, Rothe, et al., 2022) which, in fact, result in higher perception of stress (Wekenborg et al., 2019) that hinders flow experience. While burnout symptoms are connected with the physiological markers of chronic stress (Penz et al., 2018; Wekenborg, Schwerdtfeger, Rothe, et al., 2022) but not necessarily with acute stress markers (Wekenborg et al., 2019), flow seems to be associated with acute stress markers (e.g., Peifer et al., 2014) which may depend more on short-term and mutable situations. This may be because flow experience

depends on many different conditions (Barthelmäs & Keller, 2021) and varies throughout the day (Debus et al., 2014) depending on the activities performed (Engeser & Baumann, 2016). This could indicate that flow experience is more dependent on short-term physiological states than on long-term states. According to the results of this study, the extent to which subjective stress perception mediates the relationship between burnout symptoms and flow should be investigated.

6.6.2 Strengths and Limitations

The present study has some strengths: First, we used a large and heterogeneous sample so that the results can be generalized to different work contexts and age groups. Nevertheless, it should be noted that this study was carried out in Germany only and most participants were born there. This may have caused the sample to be less ethnically diverse. In addition, it could be interesting to take a more differentiated look at individual sectors and industries in order to examine whether the associations found in our study exist across different sectors or whether certain jobs are particularly susceptible. As a second strength, in this study we used different methods to investigate the relationships and mechanisms of burnout symptoms and flow. Thus, in addition to self-reports, various physiological markers were also examined. Third, a longitudinal design was chosen to test long-term effects alongside the cross-sectional associations. Fourth, despite the MBI-GS total score and a flow total score, we also analyzed the sub-dimensions of the MBI-GS and the flow facets. Since the review by Aust et al. (2022) showed that various sub-dimensions of burnout or the facets of flow were considered to different extents in earlier research and in some cases reported different associations, it was important in this study to consider all sub-dimensions of burnout as well as the facets of flow. It should be noted that there is still no consensus in flow research as to whether flow experience is a discrete phenomenon or a continuous phenomenon (see Peifer & Engeser, 2021). Assuming the discrete view, all facets of flow would have to occur simultaneously (at least over a certain threshold) in order for flow to be experienced at all. However, there is also the approach that assumes that the facets occur to varying degrees and that this may influence the intensity of flow experience (Peifer & Engeser, 2021). Accordingly, a simultaneous consideration of the total value and the facets, as was done in this study, seems worthwhile, as this discussion is still ongoing.

Nevertheless, this study also had some limitations: First, flow experience was only measured at t_1, so we were not able to test the longitudinal effects of flow on burnout symptoms. The bidirectional relationship would need to be tested in a further study also examining flow experience longitudinally. Then it would be possible to test whether, in addition to the upward spiral between flow and personal and organizational resources (Salanova et al., 2006), there is also a reciprocal influence between flow and burnout symptoms. Thus, fewer burnout symptoms could lead to more frequent flow, which, in turn, could lead to fewer burnout symptoms; flow could, for instance, be considered to protect against symptoms of burnout.

Second, the time interval between measurements can also be discussed. Earlier studies used significantly shorter periods (maximum 6 months, Lavigne et al., 2012). In the future, multiple measurement time points could be used at shorter intervals. Especially with regard to the stability of HRV parameters, there is still disagreement (Bertsch et al., 2012; Uhlig et al., 2020) and there is a lack of studies considering large time spans (Wekenborg, Schwerdtfeger, Aust, & Verkuil, 2022), therefore more research and long-term measurements are needed. In addition, multiple measurement points over a longer period of time could be used to test the theoretical assumption that flow without sufficient recovery can promote burnout symptoms in the long term (Aust et al., 2022). Third, detailed analysis of all facets and sub-dimensions has resulted in many statistical tests. Nevertheless, we considered the additional testing with depression as a control variable relevant as there are also assumptions that burnout symptoms are not significantly different from symptoms of depression and thus the burnout construct has no additional value (Bianchi et al., 2013). However, our results suggest that burnout symptoms have explanatory value beyond depression relating to flow or for predicting flow. Fourth, we had to slightly adjust the procedure compared to the preregistration. This was partly because consistency was to be ensured and HRV and questionnaire data were to be from the same survey (data from 2018 rather than 2020 were used). As the physiological markers of chronic stress were only captured in 2018 and not in 2020, we decided to use the questionnaire data from 2018 as well and not, as preregistered, the questionnaires from 2020. Moreover, we did not test the preregistered hypotheses regarding several mediating factors as it would have exceeded the scope of the paper.

6.6.3 Practical Implications

Our findings, which indicate that burnout symptoms can lead to less frequent flow in the long term, provide a starting point for measures to promote flow. Thus, our study supports the need for preventive programs against burnout (for an overview see Awa et al., 2010). Nevertheless, it should be mentioned that studies on interventions with the aim of alleviating burnout symptoms have yielded mixed results (for an overview see Ahola et al., 2017). In a meta-analysis Ahola et al. (2017) examined four individually-focused interventions and found no effects in the alleviation of burnout symptoms. They suggest developing and evaluating interventions against burnout more systematically. A recent meta-analysis focused on the effects of social and emotional learning interventions among teachers (Oliveira et al., 2021) and found that these interventions led to less emotional exhaustion and higher personal accomplishment. Whether this can also be applied in other areas should be tested. Another study found that cognitive behavioral therapy (CBT) including, for example, the identification of valuable activities and activity scheduling as aspects of the therapy, led to a greater decrease in burnout symptoms compared to a return-to-work intervention. The positive effects of the CBT on burnout symptoms were mediated by an increase in perceived competence (Santoft et al., 2019). The increased perceived competence could be another mechanism explaining the relationship between burnout symptoms and flow. Increased perceived competence could also lead to more flow experience, because potentially stressful situations could be interpreted more often as a challenge if individuals perceive that they have the competence to cope with them (Peifer & Tan, 2021). This may indicate that the CBT led to a decrease in burnout symptoms and an increase in flow experience simultaneously via an enhanced feeling of competence. Furthermore, cognitive bias modification could counteract the negative interpretation patterns in burnout symptoms (Bianchi & Da Silva Nogueira, 2019). Transcranial stimulation represents another possible intervention, as it can both enhance flow experience (Gold & Ciorciari, 2019) and alleviate burnout symptoms (Wilczek-Rużyczka et al., 2021). Future studies should investigate if there are reciprocal relationships during therapy between burnout symptoms and flow. All in all, the development and evaluation of interventions to combat burnout symptoms seem very important. In the long run, effective interventions could also strengthen flow experience, resulting in improved well-being

and performance. Due to the suggested reciprocal effect between burnout symptoms and flow, interventions that enhance flow might also alleviate burnout symptoms in the long run.

Finally, our cross-sectional results show an association of increased flow experience with reduced burnout symptoms. While our study could only test the long-term effects of burnout symptoms on flow, a reciprocal relationship between these concepts is also possible (see Aust et al., 2022). Accordingly, flow-promoting interventions could be implemented at the workplace (Peifer & Wolters, 2021) to promote flow and to potentially reduce alleviate burnout symptoms.

6.7 Conclusion

The results of this study support earlier empirical findings that flow and burnout symptoms are negatively associated with each other. This study is the first (1) to systematically consider the relationships between various sub-dimensions of burnout and facets of flow, (2) to use a heterogeneous sample, (3) to examine both cross-sectional and longitudinal data, and (4) to consider a time period of over three years. Thus, our study provides evidence that the consequences of increased burnout symptoms also have long-term effects on subjective experiences, in this case the frequency of flow. This underscores the importance of interventions to reduce burnout symptoms. Nevertheless, as reciprocal effects were not investigated in this study, future research could do so and also look at flow as a potentially protective factor against burnout symptoms.

7 General Discussion

In this dissertation, flow in the work context was examined as a central construct. Within three studies, different influencing factors and consequences of flow were considered. More precisely, aspects of teamwork were analyzed in relationship to the experience of team flow. Furthermore, the relationship between burnout symptoms and flow was investigated. Based on the findings in these studies the Transactional Model of Stress and Flow (Peifer & Tan, 2021) will be expanded with two relevant aspects of today's work environment: teamwork and the experience of burnout symptoms.

In Study I, a questionnaire study with firefighters was used to examine whether different stressors and resources that occur during teamwork are associated with the experience of team flow. It was found that the more frequently teamwork stressors occur, the less frequently team flow is experienced, and teamwork-related resources were associated with more frequent team flow.

Regarding the relationship between burnout symptoms and flow, a systematic review was conducted in Study II. Based on theoretical assumptions and previous empirical findings, the Flow-Burnout-Model was developed that presents explanatory approaches for the relationship between burnout symptoms and flow. In the model a bidirectional, primarily negative relationship between burnout symptoms and flow is postulated. The experience of stress and the physiological reaction to it is considered as possible underlying mechanism.

Based on this, we conducted a longitudinal questionnaire study (Study III) to examine the relationship between burnout symptoms and flow in more detail and to investigate possible underlying mechanisms in terms of physiological markers of chronic stress. Both cross-sectional and longitudinal negative associations were found between burnout symptoms and flow. These negative associations were evident for total scores as well as for the different sub-dimensions of burnout and the different facets of flow. However, no associations were found between flow and physiological markers of chronic stress.

In the following, the findings from the Studies I, II and III are briefly summarized and integrated into the Transactional Model of Stress and Flow, thereby answering the research questions. Furthermore, strengths of the dissertation are presented as well as limitations and challenges in researching flow, team

flow and burnout symptoms. Additionally, implications for future research and practical implications are derived.

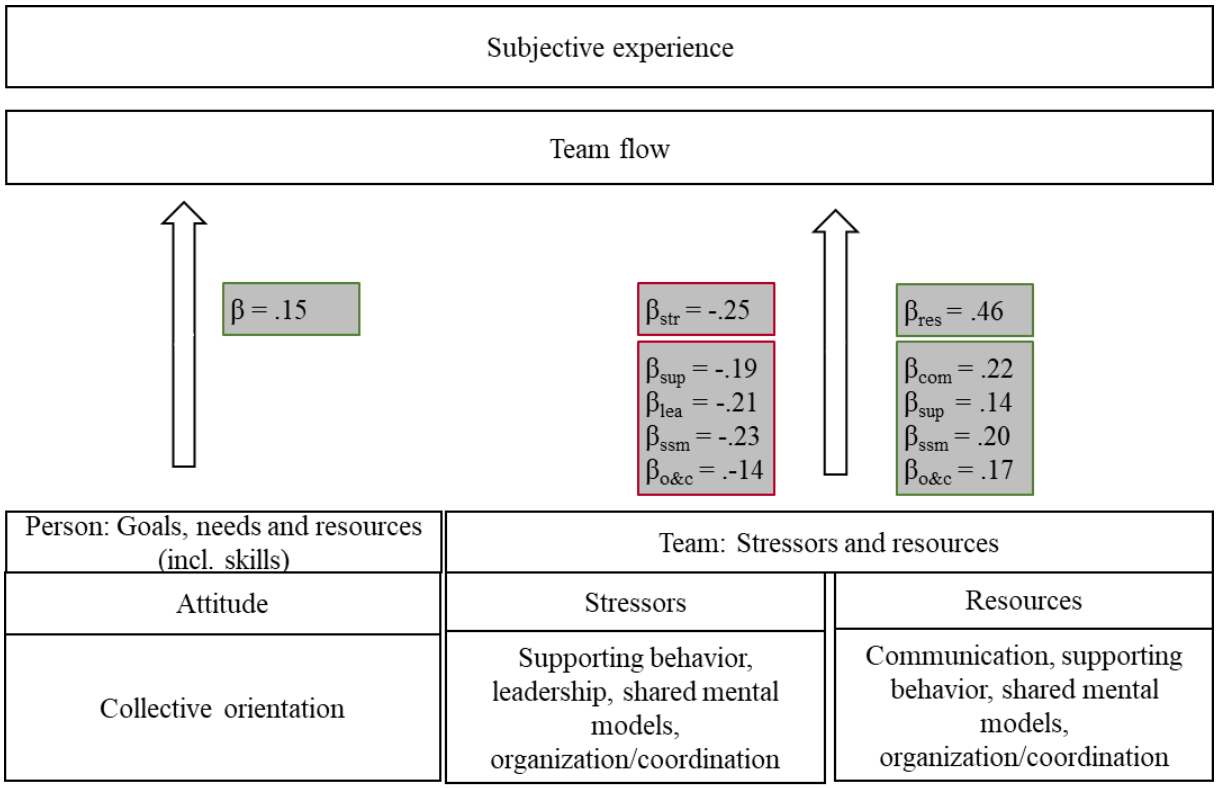
7.1 Summary and Integration

The aim of this dissertation was to provide further insights into the area of the flow experience at work and to investigate relationships with teamwork and burnout symptoms in more depth. With regard to teamwork, the extent to which specific stressors and resources that occur during teamwork can influence team flow was investigated (Study I). In addition, burnout symptoms were considered as potential long-term consequences. First, an overview of existing research results was compiled (Study II), and based on this, an empirical study was conducted, which took physiological parameters into account (Study III). The overarching aim of this dissertation was to extend the Transactional Model of Stress and Flow by Peifer and Tan (2021) regarding these aspects. In the next section, the results from the three studies are summarized and classified into the current state of research. The findings from these studies are then used to answer the different research questions and, in this process, derive an extended model.

7.1.1 Insights into Team Flow

In terms of team flow, this dissertation has shown that stressors and resources that occur while working in a team are related to team flow. Regrading the stressors, it was shown that frequent experience of stressors in the categories of supporting behavior, leadership, shared mental models, and organization/coordination, is associated with less frequent team flow. Resources in the categories of communication, supporting behavior, shared mental models, and organization/coordination were associated with more frequent team flow. Moreover, collective orientation was positively associated with team flow (see Figure 7.1). Overall, our study reflects the four assumed additional components of team flow – communication & feedback, shared goal commitment, equal participation, and trust in each other's knowledge, skills, and attitudes (Peifer et al., 2021). This is explained in more detail in the following.

Figure 7.1 *Overview of the associations found between collective orientation, teamwork-related stressors and resources with team flow*



Note. Results from the study by Aust, Heinemann et al. (2023). Only significant results are reported. Com = communication, lea = leadership, o&c = organization & coordination, res = resources (total score), ssm = shared mental models, str = stressors (total score), sup = supporting behavior.

In our survey resources in relation to *communication* were included, for example, passing on information in a timely manner, clarity of information, or the appropriate amount of information. Paying attention to these aspects can help to ensure that communication is perceived as adequate. According to Peifer et al. (2021), the perception of appropriate *communication and feedback* represents one of the four meta-categories of team flow characteristics. In other words, our study shows which specific behaviors regarding communication can contribute to the perception of appropriate communication and thus support the team flow experience. Two qualitative studies also provide evidence that communication is an important factor for the experience of team flow (Kaye, 2016; van den Hout & Davis, 2022). In the context of digital gamers, effective communication was seen as an important factor in having positive experiences (Kaye, 2016). At work, open communication was one of the most frequently cited reasons for experiencing team flow (van den Hout & Davis, 2022).

In the subcategory *supporting behavior*, our study considered aspects such as looking out for each other or the reliability of teammates. When behaviors are exhibited that help team members to feel supported (e.g., checking on each other's equipment, responding to others' needs), this is associated with more frequent team flow. In turn, the absence of supporting behaviors and the occurrence of stressors (e.g., hectic behavior of team members, ignoring others' needs) are associated with less frequent team flow. Especially, the reliable completion of tasks could be conducive to the *trust in others' knowledge, skills and attitudes*, another meta-category postulated by Peifer et al. (2021). Reliable task completion could lead to increased trust. However, if tasks are not completed conscientiously and on time, this can lead to a loss of trust among team members and restrict team flow. Van den Hout et al. (2018) also describe high-skill integration as a prerequisite of team flow. If individual tasks are not processed, this can lead to a disrupted integration and team flow not being achieved. Looking out for each other and offering support could moreover contribute to the experience of mutual comprehension, which is positively associated with the experience of clear feedback and control (Gaggioli et al., 2017). These aspects reflect in turn two components of flow (e.g., Peifer & Engeser, 2021).

With regard to stressors in the area of *leadership*, our study considered aspects such as a lack of structures or ambiguous structures in leadership, blind following of instructions or hectic behavior by leaders. When these structures and behaviors occur, less team flow is experienced. This is consistent with the findings of van den Hout and Davis (2022), who identified inadequate leadership as a factor preventing team flow in a qualitative study. Even though there is already research on the connection between flow and leadership and, for example, positive associations between transformational leadership and flow have been found (e.g., Schermuly & Meyer, 2020), the context in which these associations are studied should be considered even more. Especially in the context of firefighting, it can be assumed that hierarchical leadership is sometimes required. This is also due to the fact that there are clear role assignments and clear decision-making structures in firefighting missions (AG-B III – LFV NRW, AGBF NRW, WFV NRW, IdF NRW, 2007; AG-F III – LFV NRW, AGBF NRW, WFV NRW, IdF NRW, 2005; Hagemann et al., 2011). Here, other aspects of leadership could be associated with team flow. This is also reflected in the way that the stressors recorded in our survey were derived from

interviews with experienced firefighters and document analyses and focus on different aspects than, for example, in transformational leadership.

In the area of *shared mental models*, our study recorded, for example, the extent to which the participants were aware of the goal of the mission and the procedure, and whether the team members also had knowledge about the others and their tasks. While the frequent occurrence of stressors regarding these aspects (e.g., team members did not know each other, goals of the assignment were unclear) was negatively related to team flow, resources (e.g., team members knew procedure and goals of the mission, team members knew enough about other functions) were positively associated with team flow. Especially the factor knowledge about the shared goal fits with the assumption of Peifer et al. (2021) that *shared goal commitment* is one of the meta-categories of team flow characteristics. Also van den Hout et al. (2018) describe a common goal as a prerequisite of team flow, which is supported by our results. Knowledge of skills and attitudes from team members can also be interpreted as a prerequisite of the meta-category *trust in each other's knowledge, skills and attitudes*. If one wants to trust the other team member's skills and knowledge, one should first gain knowledge about them (see also Sawyer, 2017). Kaye's (2016) qualitative study also showed that knowledge of other's skills is a factor described as conducive to team flow.

Another category in which stressors and resources were surveyed was *organization/coordination*. Stressors in this category included, for example, unclear or uneven distribution of tasks or failure to consider standards and safety measures, and were negatively associated with team flow, while resources (e.g., clear and fair distribution of tasks, recognizing and working on tasks independently) were positively related to team flow. The equal distribution of tasks may contribute to the perception of *equal participation*, which is a meta-category of team flow (Peifer et al., 2021). Quinn (2005) also describes effective interaction as a prerequisite of team flow. The aspects and behaviors mentioned in the organization/coordination category could contribute to this.

Our study also showed that collective orientation, i.e., the propensity to prefer working in a team (Driskell et al., 2010; Hagemann, 2017), is positively associated with team flow. This also fits well with previous assumptions and findings. It has already been shown that if team members are collectively

orientated, they coordinate better (Hagemann et al., 2021) and are more responsive to each other's inputs (Salas et al., 2008). This could strengthen the sense of unity and sense of joint progress, both characteristics of team flow (van den Hout et al., 2018).

On a more general level, a recent approach by Pels and Kleinert (2022) should be considered. They present the integrative group flow theory, in which different approaches to the aspects of flow experience in teams are integrated. The theory assumes that group flow, which can be understood synonymously with team flow, occurs when group actions are balanced. These balanced group actions are defined as "continuously perfectly fitting handling of the task by the group system in a given situation" (Pels & Kleinert, 2022, p. 1). On the individual level, the group members must be aligned, i.e., the tasks of the group members must fit each other, or behaviors must be compatible. This is called primary fit and ensures that a group experience is possible. On a higher level, the group system (consisting of the compatible behavior, skills, and state of mind of the group members) and the group task in the given group environment must be compatible (secondary fit). The perception of balanced group actions is then a characteristic of group flow. The theory also describes that group flow is dynamic and even small changes at the individual level (e.g., in behavior) can influence group flow (Pels & Kleinert, 2022). Here, the results of our study can be classified in terms of the relationship between stressors and resources of teamwork and team flow. The occurrence of stressors disturbs the balance. For example, coordination problems can lead to a mismatch between the tasks of individual team members, resulting in a lack of primary fit. However, since this is a prerequisite for the secondary fit, it disrupts the flow experience in the team. Resources, however, can help maintain the balance. Collective orientation, which entails certain behaviors conducive to teamwork (Driskell et al., 2010; Hagemann, 2017; Salas et al., 2008), can contribute to the emergence of primary fit as a prerequisite for group flow.

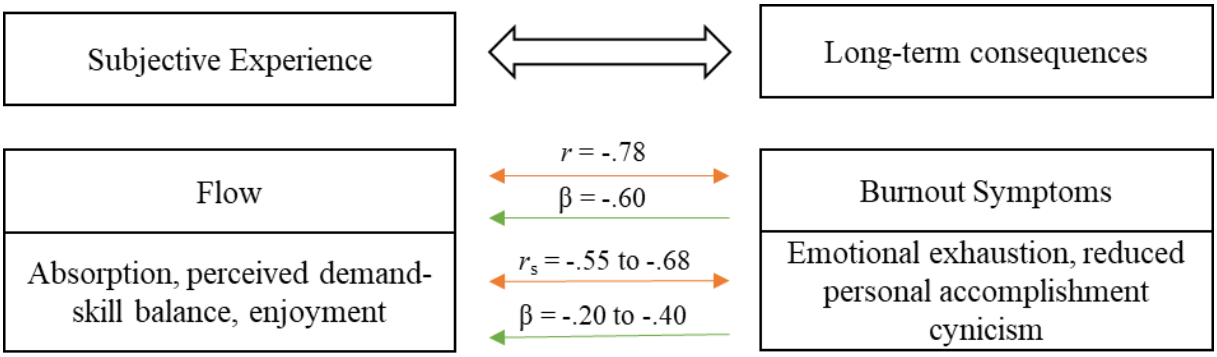
Overall, it appears that the findings from the study on the relationships between teamwork stressors and resources and collective orientation with team flow integrate well with previous research. Our study adds value to existing research by assessing very specific behaviors in the context of firefighting that can occur in a team and influence team flow. Therefore, very specific approaches to strengthening team

flow in the context of firefighting can be derived while an application to other contexts is also desirable. This will be discussed in Chapter 7.4.2 in more detail.

7.1.2 Insights into Burnout Symptoms

Regarding the association of burnout symptoms and flow, both the systematic review and the subsequent empirical longitudinal study provide evidence for a negative association. The majority of studies included in the systematic review found negative associations between the various burnout symptoms with flow and its facets. While some studies also found nonsignificant associations, there were only two studies that uncovered positive associations (Baumgarten et al., 2020; Kasa & Hassan, 2016). Since the studies included in the systematic review were conducted across different contexts, the negative association between burnout symptoms and flow seems to be quite stable. The negative associations found between burnout symptoms and flow also occurred in our subsequent study, which was conducted with over 800 employees from different industries. Here, accordingly, cross-sectional negative associations between burnout symptoms with flow and its facets were found. Longitudinally, with over 200 respondents, a negative association was also shown. Higher burnout symptoms in 2018 predicted less frequent work-related flow in 2021. For an overview of the associations between burnout symptoms and flow in our empirical study see Figure 7.2.

Figure 7.2 *Overview of the found associations of flow and burnout symptoms*



Note. Results from the study by Aust, Peifer et al. (2023). Only significant results are reported; for this figure, we used the associations that did not control for depression; orange arrows = cross-sectional results; green arrows = longitudinal association.

In general, the results can be well integrated into previous research. While burnout symptoms are associated with numerous negative consequences, like life dissatisfaction or cardiovascular illnesses

(e.g., Hakanen & Schaufeli, 2012; Melamed et al., 2006), flow is associated with various positive consequences. For example, it is often positively associated with well-being (for an overview see Llorens & Salanova, 2017; Bassi et al., 2014; Rivkin et al., 2018) and higher general health perceptions and vitality (Hirao et al., 2012). Given the associations with contrary consequences, the negative relationship between burnout symptoms and flow also seems reasonable.

Furthermore, there are numerous studies suggesting a negative relationship between engagement, a related concept to flow, and burnout symptoms (for an overview see Halbesleben, 2010). Thus, engagement is also referred to as a positive antipode of burnout (Schaufeli & Bakker, 2004). Although engagement and flow are not identical phenomena and can be differentiated with respect to various aspects (see Yan & Donaldson, 2023), they are related (e.g., Moneta, 2017). For example, Bakker (2008) already considered worth thinking whether a regular flow experience at work precedes engagement. Yan and Donaldson (2023) postulate two different mechanisms of action. They propose that employee's experiencing flow more frequently across different work activities are more engaged (within-person level). Moreover, generally engaged individuals experience flow more frequently (between-person level). Accordingly, due to the strong relationship between flow and engagement it can be suggested that these constructs have similar, negative associations with burnout symptoms.

Nevertheless, the few positive associations found between burnout symptoms and flow (or absorption as a facet of flow) should not be discounted. In the systematic review, we present a possible pathway in which steady flow with a potentially addictive nature and the accompanying moderate physiological activation, can lead to exhaustion and burnout symptoms in the long run if there is not enough time to recover. Although we have not yet found empirical evidence for these pathways, they should be considered in future research as they might help to explain heterogenous findings. If necessary, the relationships should be tested in specific samples that are susceptible to prolonged flow experience without sufficient recovery. This could be, for example, employees in start-up companies, as they have reported that flow leads to working more and neglecting other tasks (Kloep, Roese & Peifer, 2023).

Concerning the possible physiological mechanisms that could underlie the link between burnout symptoms and flow, our study could not find any associations between flow and physiological markers

of chronic stress (resting vmHRV, HCC, HCN). These markers were selected because previous studies have shown associations with burnout symptoms (Penz et al., 2018; Wekenborg, Schwerdtfeger, Rothe, et al., 2022) and to test the assumption from the Flow-Burnout-Model (Study II) that flow is related not only to acute stress markers but also to physiological markers of chronic stress. However, contrary to these assumptions, our study suggests that flow does not interact with physiological markers of chronic stress.

It is possible, though, that other stress-related mechanisms of action play a role in explaining the negative relation between burnout symptoms and flow. One approach could be that the subjective perception of stress underlies the negative relationship. Individuals suffering from burnout symptoms may evaluate potentially stressful situations as not manageable and experience subjective stress instead of flow. In an experiment by Wekenborg et al. (2019) it was already shown that individuals suffering from burnout symptoms perceived increased subjective stress.

7.1.3 Answers to the Research Questions and Integration into the Model

The findings regarding the stressors and resources of teamwork influencing team flow and the relationship between burnout symptoms and flow can be used to answer the various research questions. Thereby, the integration of teamwork and burnout symptoms into the Transactional Model of Stress and Flow is explained in more detail (see Figure 7.3).

Research Question 1: What relationships exist between stressors and resources of teamwork and the experience of team flow?

Through our study, initial assumptions of the extension could also be tested empirically. Thereby, negative associations between teamwork stressors and team flow appeared. Accordingly, disruptive factors in teamwork can counteract the emergence of team flow. In particular, a lack of supportive behavior, inadequate leadership, a lack of shared mental models, and problems with organization and coordination negatively influence team flow. Likewise, positive aspects of teamwork, such as adequate communication, supportive behaviors of team members, the presence of shared mental models, and appropriate organizational and coordination constructs can promote the emergence of team flow.

Research Question 2: How can the theoretical assumptions about the emergence of team flow be integrated into the Transactional Model of Stress and Flow considering empirical findings?

Based on the findings in Study I, the perceived stressors and resources of teamwork can be integrated as factors that are considered in the different appraisal steps when checking whether demands of the situation and coping resources match. To be more specific, these experienced teamwork stressors and resources can be used during secondary appraisal and reappraisal to assess the team's existing coping resources. Since Study I considered stressors and resources that reflect behavioral and experiential patterns of individual team members, these are classified in the Transactional Model of Stress and Flow as influencing factors on the side of the person or team. On the one hand, for example, a leader's hectic behavior or lack of shared mental models can contribute to the team's coping resources being judged as inadequate. This can cause the demands of the environment and the task to be perceived as unmanageable which may lead to stress. On the other hand, the supportive behavior of teammates or precise and appropriate communication can contribute to the team's coping resources being assessed as sufficient and the situation with the various demands from the environment and the task being interpreted as a manageable challenge. Team flow can then be experienced. However, additional requirements also emerge in the situation as a result of the teamwork (e.g., need for communication and coordination). These requirements, which arise from teamwork, are initially to be assessed as neutral and are considered on the side of the environmental and task demands.

Although this dissertation only considers stressors on the team's side, it does not explicitly mean that stressors cannot occur elsewhere in the model. For example, *environmental* stressors such as noise or heat can also be considered. In this context, it should be reflected whether the term demands, which is used in the Transactional Model of Stress and Flow, should be defined more generally, so that environmental stressors are also integrated in addition to neutral demands.

By integrating the (1) stressors and resources of teamwork as potentially influencing factors in the different appraisal steps, the (2) additional demands regarding teamwork, and (3) team flow as another outcome of the appraisal process, we succeed in extending the Transactional Model of Stress and Flow regarding aspects of teamwork.

Research Question 3: What empirical relationships have been found between burnout symptoms and the experience of flow so far?

It can be assumed that burnout symptoms and flow are negatively related to each other, as negative associations were found in the majority of cases in the systematic review. Both cross-sectional and longitudinal studies found negative relationships between burnout symptoms and flow. Different sub-dimensions of burnout as well as facets of flow were considered and yielded slightly different results. In particular, the enjoyment facet of the flow experience showed stable negative relationships with burnout symptoms.

Research Question 4: To what extent can the cross-sectional and longitudinal associations already found between burnout symptoms and flow be replicated?

In our own empirical study, the results from the systematic review were mainly confirmed. We found negative cross-sectional associations between burnout symptoms and flow as well as a negative longitudinal effect from burnout symptoms on flow. In our study the correlations between sub-dimensions of burnout and facets of flow were all in a similar high range. In general, the sub-dimensions of burnout should also be considered in the extended model, as the systematic review in particular revealed that not all sub-dimensions are related to flow to the same extent. Although this could not completely be confirmed in our study, it should be further investigated in future research.

Research Question 5: How can the theoretical assumptions on the relationship between burnout symptoms and flow be integrated into the Transactional Model of Stress and Flow considering empirical findings?

With regard to burnout symptoms, an integration into the Transactional Model of Stress and Flow as a long-term consequence seems to be reasonable. It should be noted that burnout symptoms and flow can affect each other reciprocally. This is indicated by the double-headed arrow in Figure 7.3 and based on the findings of the systematic review that flow can reduce burnout symptoms and burnout symptoms hinder flow. The latter assumption was also found in Study III. By considering burnout symptoms in the model, possible mechanisms of how burnout symptoms arise and are maintained could be derived.

For example, the cognitive appraisal process influences whether flow or stress can be experienced, which may then in turn influence the occurrence of burnout symptoms. However, it is also apparent that burnout symptoms are related to cognitive appraisal processes. Individuals suffering from burnout symptoms tend to interpret situations more negatively (Bianchi & Da Silva Nogueira, 2019) which could hinder flow. It seems that if strategies can be developed to interpret situations as challenging and manageable, flow experience becomes more likely and subjective stress decreases. This could also lead to a decrease in burnout symptoms in the long run and thereby to more positive interpretations of situations which can further drive these processes. In other words: an upward spiral could occur. The integration of burnout symptoms as consequences in the Transactional Model of Stress and Flow, which are bidirectionally related to flow, provides a good basis for further exploration of underlying mechanisms, such as the appraisal of coping resources.

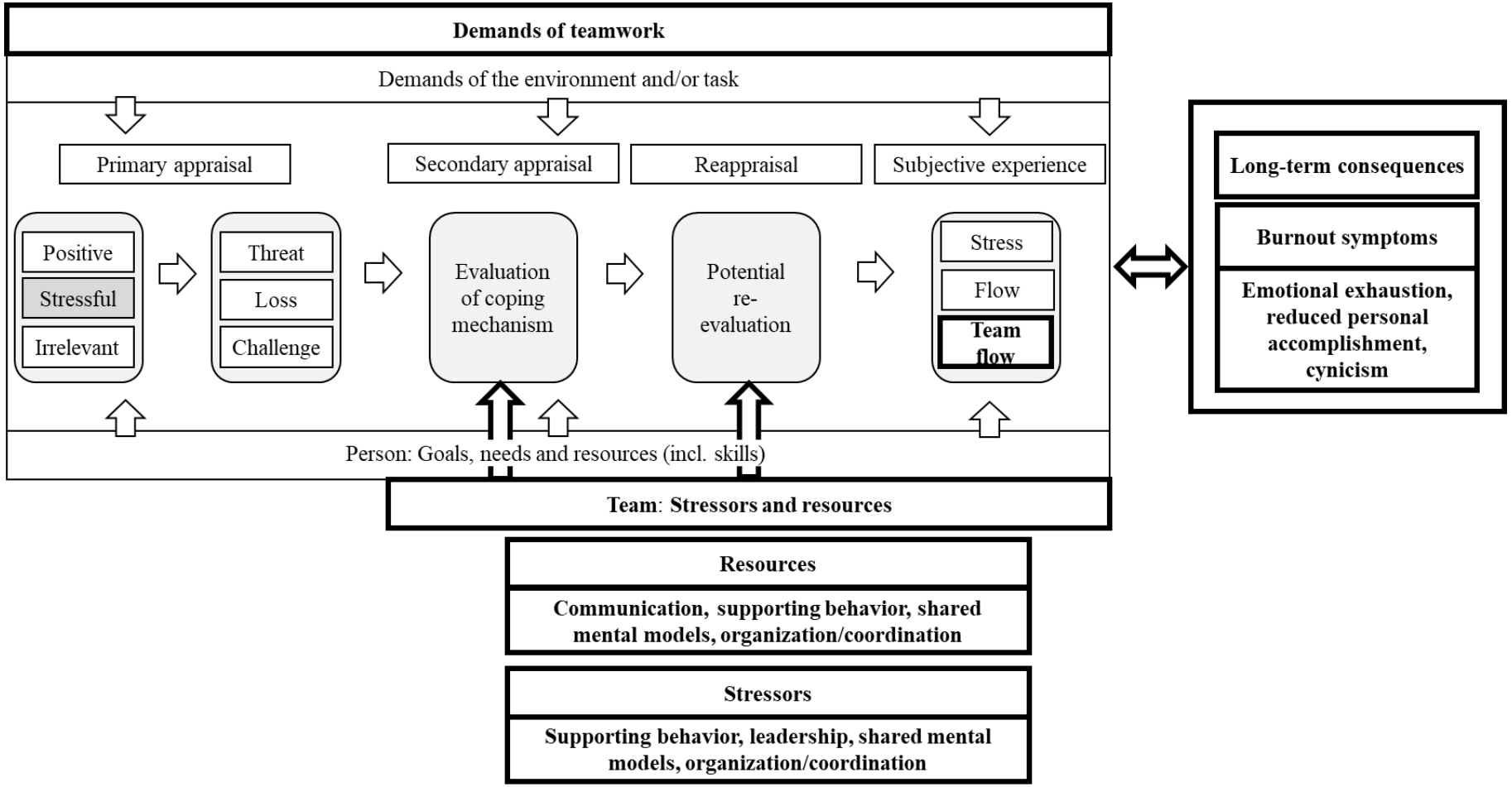
Research Question 6: What associations does flow show with physiological markers of chronic stress that are related to burnout symptoms?

Regarding the physiological markers of chronic stress, our study did not show any associations to flow, so these will not be integrated into the model for the time being. We did not find the proposed inverted u-shaped relationship between HCC/HCN and flow frequency. Moreover, the vagal tone was not associated with flow either.

Overall, it can be concluded that the Transactional Model of Stress and Flow provides a good theoretical framework for research and can be extended to include further and specific aspects in the future. For example, the Humor-Flow Model (Bartzik & Peifer, 2021), which is also based on the Transactional Model of Stress and Flow, considers humor as another resource in the appraisal process. There are also first approaches to investigate resilience as a personal resource and its influence on the appraisal process that can lead to flow (Kloep, Aust & Peifer, 2023). In this dissertation, two important aspects of work life, namely teamwork and burnout symptoms, were integrated. Theory-driven research is desirable, and the Transactional Model of Stress and Flow provides a good framework for this. Research should focus on verifying the assumed directions of action and thus provide empirical support for the model.

Potential implications for research and practice are presented in Chapter 7.4.

Figure 7.3 *Extended Transactional Model of Stress and Flow*



7.2 Strengths of the Thesis

This dissertation, along with the studies conducted, has some strengths beyond those already described in the Studies I, II and III. The most important strengths of the dissertation are described below.

Both the systematic review and the empirical studies have been designed based on a detailed literature review and are theoretically grounded. In the study regarding team flow in firefighters, possible mechanisms of action of teamwork stressors and resources on team flow are presented based on the Transactional Model of Stress and Flow, and the hypotheses are derived based on theory. The systematic review introduces the Flow-Burnout-Model, which summarizes and relates previous research findings to derive possible explanations for a relationship between burnout symptoms and flow. The theoretical assumptions of the Flow-Burnout-Model were then used to design the subsequent study, which investigated individual pathways of the Flow-Burnout-Model. This provides a good foundation for further research.

The extension of the Transactional Model of Stress and Flow to include the aspects of teamwork and burnout symptoms provides an opportunity for future research to generate further hypotheses regarding the interrelationships of the different factors. Thereby the model provides a theoretically sound and partially empirically tested basis which supports hypothesis-driven research. Furthermore, very current, and relevant aspects of today's working world are integrated into the model, further strengthening research in these areas. The integration of teamwork and burnout symptoms opens up the possibility to include additional factors in the model allowing it to be continuously expanded and adapted to different contexts. Concrete ideas will be presented in Chapter 7.4.

A variety of methods was used in the different studies. For example, in relation to team flow, a cross-sectional online questionnaire study was conducted. In particular, much emphasis was placed on the development of the questionnaire which captures the stressors and resources of teamwork in firefighting missions. The questionnaire was developed as part of the research project "Gemeinsam Stark – Teamtraining Brandbekämpfung", but not explicitly as part of this dissertation. During the development of the questionnaire, interviews and document analyses were first used to identify and cluster stressors

and resources of teamwork in the context of firefighting missions, allowing for a target group-specific query (a detailed account of the development and validation will be published soon; Heinemann et al., 2023). With regard to the association between burnout symptoms and flow, a systematic review was first conducted, i.e., a literature review. In this course, the PRISMA guidelines (Page et al., 2021) were used as a reference. The subsequent empirical study used both cross-sectional and longitudinal data. In addition, questionnaire data as well as physiological markers (vmHRV, HCC, HCN) were evaluated. Thereby, we used subjective measurements as well as objective markers. Thus, the holistic explanatory approaches could be tested.

7.3 Limitations and Outlook for Future Research

In the context of this dissertation, some limitations must be considered. In addition to the limitations mentioned in Studies I, II and III, there are some overarching pitfalls in the research fields. These relate, among others, to the definition and measurement of the various constructs considered in this dissertation. Below, some limitations are presented in more depth and suggestions are presented to overcome the limitations in future research.

7.3.1 Definition and Measurement of Flow

When considering the flow experience, it is noticeable that Csíkszentmihályi's (1975) original definition has been adapted and supplemented over time. However, there are still some pitfalls with regard to the exact definition and measurement of the flow experience:

A very recent definition by Peifer and Engeser (2021) identifies three core components that characterize the flow experience: absorption, perceived demand-skill balance, and enjoyment. Especially with regard to the *perceived* demand-skill balance, they emphasize that the *subjective perception* of this balance is a component of flow, and that the *objective presence* of appropriate demands is an antecedent. This approach was also followed in the present dissertation, as the perceived demand-skill balance was surveyed as a component of flow (Chapter 2.1.1). In contrast, Barthelmäs and Keller (2021) state that perceived demand-skill balance is a precondition for flow experience. These different labels as precondition or components of the flow experience show that in research the separation between

preconditions and components is not clear-cut. In many studies, balance is actively manipulated to create flow-favoring conditions (e.g., Keller et al., 2011; Kozhevnikov et al., 2018). Nevertheless, it seems useful to additionally elicit the subjectively perceived balance in addition to the objective fit (e.g., with the Flow Frequency Scale [FFS], Bartzik, Aust, & Peifer, 2021; Bartzik & Peifer, 2023), as according to Peifer and Engeser (2021) this represents a core component of the flow experience. By simultaneously eliciting the objective and subjectively perceived balance, underlying mechanisms of action could be investigated more precisely, and more accurate implications could be derived.

There is a multitude of questionnaires that measure different facets of flow (e.g., Work-related Flow Inventory [WOLF], Bakker, 2008; Flow-Short-Scale [FKS], Rheinberg et al., 2003; Flow State Scale [FSS], Jackson & Marsh, 1996), resulting in a lack of a standard operationalization. The questionnaires differ from each other not only with respect to the facets surveyed, but also with respect to the scales on which flow is measured. While some questionnaires ask about the intensity of the flow experience (e.g., FKS; Rheinberg et al., 2003), other questionnaires ask about the frequency (e.g., WOLF; Bakker, 2008). These methodological differences reflect a definitional problem. For example, flow research has not yet clarified whether flow represents a discrete phenomenon or whether it maps a continuum (see also Peifer & Engeser, 2021). Assuming a discrete phenomenon, only the frequency of the experience could be interrogated and not the intensity. The approach to capture flow as a discrete phenomenon was followed, for example, by Bassi et al. (2014). They found that the occurrence of flow, regardless of intensity, was related to well-being. However, in other studies, subjects are asked how intensely they experienced flow (e.g., Peifer et al., 2014; Rivkin et al., 2018). This implicitly assumes that flow takes place on a continuous basis. Peifer and Engeser (2021) propose that there may be a threshold at which the experience can be called flow at all, and that the experience then divides flow on a continuum from low intensity to very high intensity. In the context of this dissertation, the FFS from Bartzik and Peifer (2023) was used and the experience of flow in the last two weeks was surveyed. For future research, for example, diary studies could be used to query the intensity and frequency of flow experience and examine correlations with burnout symptoms. This could be used to investigate in more detail whether,

for example, a few, intense flow experiences have a different effect on burnout symptoms than many, non-intensive flow experiences.

Moreover, flow experience is considered both a state and a trait variable in research (Fullagar & Kelloway, 2009). While experimental studies in particular measure flow at one specific moment (e.g., Peifer et al., 2014; Tozman et al., 2017), other studies consider how the tendency to experience flow more frequently, referred to as flow proneness in some studies, is related to different outcomes (e.g., Mosing et al., 2018; Ullén et al., 2012). For the purposes of this dissertation, we considered the frequency of flow experience over the past two weeks. Thus, no flow *state* was considered, but neither was an overall tendency, as in the Swedish Flow Proneness Questionnaire (SFPQ; Ullén et al., 2012), so the indication can be classified between that of a state and a trait. In the future, similarities and differences between flow state and trait should be considered in more detail and it should be investigated whether the two phenomena show different correlations with various outcome variables.

Another question is whether the experience of individual facets of flow already characterizes a flow state or whether an interaction of all facets must be present. For example, in the context of physiological markers, several studies found an association only with the absorption facet, whereas fluency was not associated with the physiological markers (Peifer et al., 2014; Tozman et al., 2017). In this case, the question arises whether flow can be uniquely mapped by individual facets or whether the different facets must interact. It is feasible that all facets must be present at a certain threshold and then the facets can be differentiated (see Peifer & Engeser, 2021). In the context of this dissertation, individual facets of flow were considered as well as the total score. This revealed very consistent results. Nevertheless, thresholds for individual facets were not used in this study either, which could be considered in future research. One possibility to consider the holistic nature of the flow experience is a single item for the flow experience, which asks about the simultaneous experience of the different components (e.g., FFS and Flow Intensity Scale [FIS]; Bartzik and Peifer, 2023). This could be used in future research alongside the other items to examine whether operationalization influences the relationships found.

In previous research, as in the context of this dissertation, flow is almost exclusively surveyed by self-reports. These have the disadvantage that answers can be biased (e.g., agreement tendencies, tendency

to extremes; Paulhus, 1991; van Herk et al., 2004). Moreover, flow can so far only be surveyed retrospectively, i.e., after an activity. In order to better objectify the flow experience, the use of objective markers, for example in the form of physiological markers, could be helpful (Peifer, Kluge, et al., 2020; Peifer & Tan, 2021). A challenge here could be that patterns of physiological markers in flow can vary greatly depending on the activity (see Peifer & Tan, 2021). For example, it is expected that during jogging there is a different physiological activation at optimal functionality than during reading.

Overall, it should be noted that there are still some outstanding issues that need to be addressed regarding the definition and measurement of flow in order to increase the uniformity of the assessment of flow in the research field. However, it can also be stated that despite the methodological diversity, the positive associations with well-being and performance, for example, could be shown in many different studies (e.g., Bassi et al., 2014; Christandl et al., 2018; Demerouti, 2006; Peifer, Schönfeld, et al., 2020). This in turn suggests that these results are very reliable and that the different operationalizations have no serious influence on these associations. Nevertheless, future research should strive for a uniform approach or explicitly consider the different approaches in the explanations and discussions.

7.3.2 Definition and Measurement of Team Flow

There are also some open discussion points in the research field regarding team flow, some of which are discussed below:

In the context of this dissertation, the term team flow was used, which is also preferred by van den Hout et al. (2018). However, in addition to this term, numerous others are used that represent very similar constructs. Pels and Kleinert (2022) argue for a consistent use of the term *group flow*, as it represents a higher-level term for flow at the group level as opposed to individual flow (Raettig & Weger, 2018).

Furthermore, Hackert et al. (2023) propose a taxonomy in which different types of flow are distinguished on the basis of self-other overlap. They differentiate, based on Raettig and Weger (2018), between individual flow experienced alone (solitary flow) and in the presence of others (social flow). In the case of flow that arises in a social context, a further differentiation is made regarding the self-other overlap (co-active flow, private interactive flow, shared interactive flow). Another type of flow is group flow

which appears when the group members have to interact synchronously and in real-time. According to Hackert et al. (2023), only the phenomenon of group flow is accompanied by an experience at the group level – a collective state of mind (self and other overlap completely). This approach was followed during this dissertation since we assume that in firefighting missions the interaction in the team is in real-time. Further empirical studies are needed to test the taxonomy (see Hackert et al., 2023). These should investigate whether the different types of flow are associated with different preconditions, characteristics, and consequences, thus also legitimizing the detailed differentiation. If the different types cannot be sufficiently distinguished from each other and overlap too much, the use of an umbrella term would be useful, to counteract further misunderstandings regarding terminology and operationalization.

There is also no uniform approach to measuring team flow. Self-reports are mostly used with the disadvantages mentioned above. However, in contrast to individual flow, there are few validated measurement instruments for surveying team flow to date. While some studies measure team flow by aggregating individual flow scores, other researchers adapt items to the team level (for an overview see Pels et al., 2018). A validated instrument was presented by van den Hout et al. (2019) – the Team Flow Monitor. This is a very detailed instrument that elicits the prerequisites and characteristics of team flow that are mentioned in the framework of van den Hout et al. (2018). In this dissertation, a self-developed questionnaire was used, based on the FKS of Rheinberg et al. (2003) and the Team Flow Monitor (van den Hout et al., 2019). This questionnaire represented an economic way of surveying and considered the assumed theoretical foundations. The questionnaire was used on an individual level, i.e., the participants rated individually how they experienced team flow. In future research, our measurement tool should be further validated, and it should be tested if an aggregation on the team-level provides further insights into the team experience. Furthermore, other markers, such as physiological or behavioral markers, can be used in the future to be able to represent the state of team flow (Hackert et al., 2023; Peifer et al., 2021; Pels & Kleinert, 2022).

7.3.3 Definition and Measurement of Burnout Symptoms

Already in the theoretical background, some challenges related to the research in the field of burnout symptoms were presented. Accordingly, these will only be summarized briefly and recommendations for future research will be derived.

Despite its inclusion in the ICD-11, no clear diagnostic criteria for burnout are yet available. Accordingly, Rotenstein et al. (2018) recommend the use of a continuum approach until uniform diagnostic criteria are established to avoid methodological heterogeneity. This recommendation was followed in the dissertation. In the future, however, it is desirable that uniform diagnostic criteria be established to achieve greater consistency with respect to research and practice (see also Schaufeli et al., 2020).

Similar to the flow experience, there are numerous questionnaires that assess burnout symptoms but focus on different sub-dimensions (e.g., MBI-GS, OLBI, BAT). In addition, some use total scores and some focus on individual sub-dimensions. Similar to flow experience, the question arises whether single sub-dimensions can sufficiently represent the complex construct of burnout (Maslach & Leiter, 2016). In the context of this dissertation, the MBI-GS was used in our empirical study. Although the questionnaire is not without controversy (e.g., Schaufeli et al., 2020), it is very widely used, and the structure of the questionnaire was also used in the description in the ICD-11. Moreover, we used both total scores and sub-dimensions in our studies to better investigate mechanisms of action and to derive implications in a targeted manner. The development of an empirically validated and theory-adapted tool that is used consistently in research remains desirable. The BAT of Schaufeli et al. (2020) may be a promising approach for this purpose.

Another challenge in the field of burnout research is the insufficient differentiation from depression. For example, it is still debated whether burnout and depression are two distinct constructs (e.g., Koutsimani et al., 2019) or whether they are separable at all (e.g., Bianchi et al., 2015). Consideration of physiological markers provides an approach to find possible overlapping and separable aspects regarding the two constructs (e.g., Penz et al., 2018; Wekenborg, Schwerdtfeger, Rothe, et al., 2022). In our study, we controlled for the occurrence of depression and the results provide evidence that the

concepts overlap but also have unique parts. It also seems useful in future research to consider the proximity of the two concepts and to examine similarities and differences in detail.

7.3.4 Sample and Data Collection

There were also some limitations regarding the sample and evaluation methods, some of which are briefly described below:

While a very specific sample was chosen for the study on team flow, namely firefighters, the empirical study on the relationship between burnout symptoms and flow was conducted using a very heterogeneous sample with employees from many different fields. Both approaches have advantages and disadvantages. For example, the specific sample leads to the fact that very concrete behaviors could be queried, which are of practical importance in the field of firefighting. Thus, the items on teamwork stressors and resources could be explicitly adapted to the firefighting context and did not have to be formulated generically. That is why very specific implications could be derived. However, this limits the transferability to other contexts. For example, it can be assumed that teams working together in offices experience different stressors and resources of teamwork than firefighters. Accordingly, the interrogation of teamwork stressors and resources would need to be adapted for each context in order to find further support for the results. The heterogeneous sample from the study on burnout symptoms and flow has the advantage that the results can be directly applied to many contexts. However, it does not account for industry-specific differences and increases the number of potentially confounding variables. Also, no specific implications can be made for particular employment groups. Thus, it can be concluded that both approaches have their justification and that it should be made dependent on the specific question whether a heterogeneous sample is chosen for higher generalizability or a specific sample with which very specific implications can be derived.

Regarding the collection of data, one criticism already mentioned is the focus on self-reports with the associated drawbacks. Furthermore, it should be noted that vmHRV was measured in a resting condition. However, for economic reasons, this resting measurement was not independent of other measurements (like venipuncture or different stress tests). In addition, resting vmHRV was only assessed once.

However, Bertsch et al. (2012) recommend that if vmHRV is to be used as a trait-like marker (as in our study), at least two measurement time points should be aggregated.

With regard to data collection, it should also be noted that Study I was conducted in a cross-sectional design and subjects were required to retrospectively look back at their experienced missions. This could have been difficult, especially for firefighters with a long professional experience. Furthermore, individual, very special missions could distort the assessment. In future, longitudinal or experimental studies should be planned to determine the directions of the effects better.

7.4 Implications

The results of this dissertation provide further starting points for future research and the derivation of practical implications, which are presented below.

7.4.1 Implications for Future Research

As briefly outlined above, the extended Transactional Model of Stress and Flow provides the groundwork for hypothesis-driven research. Using the model, various pathways of action can be derived and tested, and extensions can be made. For this purpose, qualitative approaches can be used, for example, to open new application contexts, as well as quantitative approaches to verify the assumptions. In particular, longitudinal studies are desirable, in order to examine causal relationships in detail.

In the further use and revision of the Transactional Model of Stress and Flow, attention should be paid to the wording of individual model components. Based on the stress model of Lazarus and Folkman (1984), it is described that in the primary appraisal, i.e., before the evaluation of one's own coping resources, a situation can be described as a challenge. In this course, a discussion similar to that of the Flow Channel Model (Csíkszentmihályi, 1975) arises regarding the concept of *challenge* (Barthelmäs & Keller, 2021; Rheinberg & Engeser, 2018). Rheinberg and Engeser (2018) emphasize that a challenge only arises in alignment with a person's capabilities. Accordingly, the use of this term in the primary appraisal would have to be dispensed with, since assessment as a challenge only emerges in the secondary appraisal when it is compared with coping resources.

As described above, the use of the term *demands* could also be discussed. The term is used heterogeneously in research. For example, while the term is considered neutral in the perceived demand-skill balance, a main component of the flow experience (Peifer & Engeser, 2021), it tends to have negative connotations in the Job Demands-Resources Model (JD-R Model; Bakker & Demerouti, 2007). Probably, the Transactional Model of Stress and Flow could introduce a superordinate term that would then be supported by examples, similar to what was done for the person side (e.g., Environment and Task: requirements, stressors, ...).

Further research can also be conducted on the effects of teamwork stressors and resources on team flow. In addition to the firefighting context, there are numerous other work contexts in which teamwork is indispensable and it should be investigated whether, for example, teams with creative tasks experience different stressors and resources of teamwork that have an influence on team flow. In this way, the model offers a general explanatory approach, which then can be adapted to specific target groups. For example, the perception of existing coping resources in different contexts is central to the emergence of team flow, but which factors are explicitly used to assess coping resources depends on the context.

Moreover, various aspects of the new working environment could be considered within the model. For example, application in the field of artificial intelligence seems useful, as today's workplace is increasingly dependent on innovations in this area. It could be examined whether the use of artificial intelligence has an impact on how manageable employees interpret workplace demands and how they engage (Hughes et al., 2019). On the one hand, the use of artificial intelligence could lead to unpleasant tasks being delegated to artificial intelligence and the remaining tasks being perceived as challenging and manageable, which promotes flow. On the other hand, the use of artificial intelligence could also make employees feel less autonomous, which is important for experiencing flow (Demerouti, 2006). Thereby, flow could be decreased due to artificial intelligence.

The model could further differentiate with respect to the various facets of flow and team flow in order to examine which influencing factors have an impact on which facets of flow. Also, with respect to burnout symptoms, our review showed that individual facets of flow were particularly consistently related to some burnout sub-dimensions. Future research should investigate further specific influences

in order to derive adequate implications. However, it should be kept in mind, as described in Chapter 7.3.1, that it has not yet been finally clarified in research whether the experience of individual facets of flow is sufficient for a flow experience or whether all facets must be present at least at a certain threshold (Peifer & Engeser, 2021). Similar discussions appear regarding burnout symptoms (Maslach & Leiter, 2016).

In addition, physiological markers could also be integrated into the model, as in the Flow-Burnout-Model. In this context, the extent to which stress and flow states differ in terms of physiology should be investigated. Differentiating stress and flow on a physiological level could also benefit research regarding the objective measurement of flow. If activation patterns typical of flow can be identified, this may lead to a more objective measurement of flow in future research (see also Peifer & Tan, 2021). In this course, long-term consequences of physiological activation in stress and in flow could also be compared. For example, as suggested in Study II, steady moderate physiological activation in flow, could also lead to negative consequences in the long term if adequate breaks and rest periods are not taken. Longitudinal studies that steadily collect physiological markers over an extended period of time would be helpful in this regard to identify changes in both the short-term stress response and with respect to chronic stress markers.

In addition to the long-term consequence of burnout symptoms, other outcomes of stress and flow experience could also be integrated into the Transactional Model of Stress and Flow. In doing so, the three sphere framework (Peifer & Wolters, 2021) could be used as a guide and, in particular, the consequences on the individual and organizational level could be considered. Especially the integration of performance variables and well-being could lead to a holistic view of the factors that cause stress or flow and the consequences. In this context, a separation between short-term and long-term consequences seems to be quite reasonable, since, as proposed in Study II, short-term positive effects of flow in combination with potential addiction can also lead to long-term negative consequences. In this course, it could also be investigated whether burnout symptoms are also related to team flow. Since the two concepts have so far been introduced into the model independently of each other, it could be investigated in the future how they are related to each other.

The study on team flow focused on how stressors and resources of teamwork can influence team flow. However, future research should also examine the additional demands of teamwork. In this course, it could be investigated which additional requirements arise from working in a team, such as communication and coordination needs (e.g., Marks et al., 2001), and whether these vary in different professional contexts. In this context, it should be examined how tasks in teams should be designed to enhance team flow.

Generally, the possible negative consequences of flow and team flow should be given more attention in future research (see also Zimanyi & Schüler, 2021). The main positive framing could lead to overlooking disadvantages of flow. In the context of firefighting, potential negative consequences seem to be possible. For example, if absorbed in a firefighting mission, one might miss important external stimuli, but these would require an adjustment in strategy. In the worst case, for example, a person to be rescued could be overlooked or possible dangers could not be recognized. In this context, the description of Pels and Kleinert (2022) could be relevant. They describe team flow as dynamic. Thus, processes must therefore be adapted to the changed situation in order to maintain team flow. New stimuli from the environment can lead to situational changes that require behavior adaption. Future research should investigate whether new, important stimuli are still adequately perceived in the state of team flow and whether an adaptation takes place. Thus, it should be considered situation-specifically whether a flow state is always desirable, or for which tasks the negative aspects predominate.

7.4.2 Implications for Practice

In today's work environment, it is nearly impossible to prevent individuals from being exposed to various stressors. However, the individual handling of the stress-relevant situations is crucial. As described in the Transactional Model of Stress and Flow, individuals who have sufficient coping resources can interpret potentially stressful situations more as challenges and thus experience flow (Peifer & Tan, 2021). Given the mainly positive effects of flow and team flow on performance and well-being (e.g., Bassi et al., 2014; Rivkin et al., 2018; van den Hout et al., 2019), strengthening flow-promoting factors seems desirable.

In this dissertation, factors related to team flow were specifically identified. Since teamwork stressors and resources of teamwork were shown to be associated with team flow, it is reasonable to use this as a starting point for interventions. In this context, strengthening teamwork processes seems to be an important starting point to reduce stressors which impair team flow. In the same way, resources should be built up and strengthened, as these can support the experience of team flow. In doing so, both reducing stressors and strengthening resources can reinforce the perception that the team is competent to handle the situation. Study I provides evidence that in the context of firefighting, training regarding the aspects of communication, supportive behavior, leadership, shared mental models, and organization/coordination can be helpful to enhance team flow. Approaches to strengthening these so-called non-technical skills are provided, for example, by Crew Resource Management (CRM) trainings, which train knowledge, skills, and attitudes of what is necessary for successful teamwork (Hagemann, 2011; Salas et al., 1999, 2006). Since CRM training is also applied in other occupational areas it stands to reason that team flow can be strengthened in these areas as well. Especially in the field of other High Responsibility Teams (HRTs), such as emergency medical services or police, that have to work under similar circumstances (Hagemann et al., 2011), similar stressors and resources of teamwork might be relevant. Nevertheless, the specific needs of each occupational group should be assessed prior to the use of CRM training following the approach of Goldstein and Ford (2002). The training should be adapted accordingly. Teamwork processes are also relevant outside of HRTs. However, in other contexts such as creative professions, it would first be necessary to record which stressors and resources of teamwork are typical for this occupational group. It can be assumed that teams working in the office face different teamwork related stressors than teams in the fire department. The six categories regarding stressors and resources of teamwork collected in Study I can be used as orientation (communication, supporting behavior, leadership, shared mental models, organization & coordination, decision-making), as they are very superior and broad, and can be applied in many contexts. The individual items would have to be adapted to the specific needs. In this context, qualitative surveys in the teams could be used in order to be able to derive needs in a targeted manner. As a further orientation, the framework of team processes (Marks et al., 2001) could be used, which generally describes and classifies team processes. In practice, training could also be offered on a need's basis (see Goldstein & Ford, 2002), i.e., teams with

problematic communication structures could be offered explicit communication training, while another team with problems in the responsibility management could receive a leadership training.

Even though the focus of this dissertation is not on the additional demands that arise from teamwork, this should be taken into account in practice. Care should be taken to ensure that not too many demands are placed on the teams, so that the team's resources are sufficient to cope with the tasks.

Due to the negative associations that have been found between burnout symptoms and flow, various strategies should be used to strengthen flow and avoid burnout symptoms. Based on the Transactional Model of Stress and Flow, it can be inferred that the subjective appraisal process plays a crucial role in whether flow or stress is experienced (Peifer & Tan, 2021). In order for situations to be perceived as a manageable challenge more often, various approaches seem to make sense. On the one hand, coping resources in the *individual* should be built up on the person's side referring to the Transactional Model of Stress and Flow. On the other hand, the *environment and the task* should be addressed and the conditions for flow should be improved. In this context, aspects from the three spheres model of Peifer and Wolters (2021) could be used since flow-strengthening approaches are shown for both – the person's side and the task and environment side.

On an *individual level*, interventions of the field of Positive Psychology that focus more on strength building and are intended to promote flow could be used (for an overview see Yan & Donaldson, 2023). Moreover, interventions from the field of burnout prevention and treatment can also help to build up resources on the person's side. For example, some interventions are partly aimed at strengthening the experience of competence and changing evaluation patterns. Within the framework of a cognitive behavioral therapy (CBT), for example, desirable activities of the participants are identified, and activity plans are designed. These led via an increased perceived competence to less burnout symptoms (Santoft et al., 2019). With respect to the Transactional Model of Stress and Flow, increasing the sense of competence could also help in the appraisal process to perceive the situation as manageable and to experience flow. Further, cognitive bias modification has been shown to be effective in helping with anxiety symptoms (for an overview see Jones & Sharpe, 2017). For individuals suffering from burnout symptoms, negative interpretation patterns particularly appear (Bianchi & Da Silva Nogueira, 2019),

which may lead to interpreting stress-relevant situations more often as not manageable. Therefore, cognitive bias modification might also be relevant for the context of burnout symptoms, as a change in cognitive bias might lead to a more positive interpretation of a situation (Bianchi & Da Silva Nogueira, 2019) which could come along with the subjective feeling that potentially stressful situations are seen as a solvable challenge. This could increase flow and decrease burnout symptoms in the long run. In addition to these concrete intervention approaches, other resources within the person could be strengthened, such as self-efficacy or PsyCap, based on the three spheres framework (Peifer & Wolters, 2021). Overall, it appears that interventions designed to promote flow and interventions that can reduce burnout symptoms partially adopt similar approaches with the aim of changing the appraisal process of a stress-relevant situation that influences the experience of flow.

In addition to strengthening coping resources, it can be concluded from the Transactional Model of Stress and Flow that the demands of the *environment and task* provide another adjusting factor to strengthen flow. The three spheres framework can also be used as a basis to derive different starting points (Peifer & Wolters, 2021). For example, clear goals should be set for tasks or multitasking should be reduced (e.g., Peifer & Zipp, 2019; Weintraub et al., 2021). Regarding the organizational and social sphere, social support should be promoted, and adequate leadership styles should be used (e.g., Peifer & Wolters, 2021; Salanova et al., 2006; Schermuly & Meyer, 2020).

When strengthening flow in the workplace, it should not be forgotten that breaks and rest periods are important (e.g., Baumann et al., 2016; Debus et al., 2014). With reference to the pathways in the Flow-Burnout-Model, it should be avoided that flow at work becomes an addiction and triggers negative consequences, such as workaholism.

7.5 Conclusion

The concepts of (team)flow and burnout symptoms have long since entered the vernacular of many people. The task of research is to distinguish itself from everyday psychological assumptions through theory-driven and empirically grounded research. In doing so, the Transactional Model of Stress and Flow, which was extended in the context of this dissertation, can be used as an important foundation.

Because flow is generally associated with many positive outcomes and is described as an alternative subjective experience to stress, it seems important to examine starting points for strengthening flow. In the context of this dissertation, two aspects of today's working environment were considered in relationship with flow: teamwork and burnout symptoms.

In summary, based on the findings that stressors of teamwork hinder team flow while resources of teamwork enhance it, it can be suggested that strengthening team processes contributes to an increased team flow experience. Likewise, reducing burnout symptoms is desirable and may support an enhanced flow experience.

In a working world where stress-related illnesses are on the rise, it is important to help employees reduce stress and strengthen their health. Since the occurrence of stressors cannot be entirely prevented, strategies for dealing with stress-relevant situations should be learned. Perceiving the potentially stressful situation as a challenge is conducive to flow and can prevent employees from feeling stressed in a negative way. In this regard, it is important to have sufficient coping resources to allow the perception of challenge to develop. This dissertation offers approaches for how these coping resources can be built up. For instance, strengthening non-technical skills in teamwork can prevent the occurrence of teamwork-related stressors that have a negative relationship with team flow. Likewise, strengthening resources can promote team flow. Moreover, burnout symptoms should be reduced through strength-based interventions so that flow can be experienced.

New starting points for research are also emerging based on this dissertation. Thus, the found relationships with stressors and resources of teamwork should be investigated in other working contexts and examined in more detail in experimental or longitudinal studies. For the association between burnout

symptoms and flow, the bidirectional relationships should be considered in more detail in longitudinal studies and possible mediating factors, such as subjective stress experience or appraisal patterns, should be examined more closely.

As emphasized at the beginning, employees are often exposed to stress, which can have various negative consequences. With the help of this dissertation, concrete starting points for strengthening flow are derived so that the reduction of stress in the workplace can be promoted. However, encouraging flow can only offer one approach in a complex work environment, which should always be considered in conjunction with other stress-reducing interventions.

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9 Appendix

9.1 Appendix A: Supplementary Material – Study I

Table A4.1 *Assessment of team flow (developed based on Rheinberg et al., 2003 and van den Hout et al., 2019)*

1.	We felt optimally challenged as a team. [Wir fühlten uns als Team optimal gefordert.][1]
2.	My team was able to concentrate effortlessly on the joint task. [Mein Team konnte sich mühelos auf die gemeinsame Aufgabe konzentrieren.][1]
3.	My team was completely absorbed in completing the task. [Mein Team war ganz vertieft in die Erledigung der Aufgabe.][1]
4.	We had complete trust in each other. [Wir hatten vollstes Vertrauen ineinander.][2]
5.	We knew that we could accomplish the task together. [Wir wussten, dass wir die Aufgabe gemeinsam bewältigen konnten.][2]
6.	My team felt that they were in control of the task. [Mein Team hatte das Gefühl, die Aufgabe unter Kontrolle zu haben.][1]
7.	The teamwork was fluid and smooth. [Die Zusammenarbeit im Team verlief flüssig und glatt.][1]
8.	Everyone in the team knew what to do at all times. [Jeder im Team wusste jederzeit was zu tun ist.][1]
9.	The cooperation in the team worked as if by itself. [Die Zusammenarbeit im Team klappte wie von selbst.][1]
10.	The team acted in unity. [Das Team handelte als Einheit.][2]
11.	Our actions were optimally coordinated. [Unsere Handlungen waren optimal aufeinander abgestimmt.][1]
12.	We were fully involved with the team. [Wir waren voll in das Team eingebunden.][2]

Note. Translated items. The questionnaire was used in German. [1]based on Rheinberg et al. (2003). [2]based on van den Hout et al. (2019)

Table A4.2 *Factor loadings of the CFA for stressors of teamwork*

Latent Variables		Estimate (Std.Error)	Standardized	*p*
Stressor – Communication	Item 1	1.000	0.631	
	Item 2	1.030 (0.084)	0.696	< .001
	Item 3	0.868 (0.102)	0.618	< .001
	Item 4	0.912 (0.112)	0.578	< .001
	Item 5	0.918 (0.114)	0.599	< .001
	Item 6	0.830 (0.121)	0.528	< .001
Stressor – Supporting behaviour	Item 1	1.000	0.651	
	Item 2	1.019 (0.102)	0.672	< .001
	Item 3	0.949 (0.094)	0.610	< .001
	Item 4	1.072 (0.117)	0.612	< .001
	Item 5	0.578 (0.100)	0.357	< .001
	Item 6	1.041 (0.102)	0.721	< .001
Stressor – Leadership	Item 1	1.000	0.393	
	Item 2	1.770 (0.302)	0.711	< .001
	Item 3	1.481 (0.255)	0.703	< .001
	Item 4	1.492 (0.239)	0.687	< .001
Stressor – Shared Mental Models	Item 1	1.000	0.698	
	Item 2	0.697 (0.100)	0.511	< .001
	Item 3	0.916 (0.109)	0.606	< .001
Stressor – Organization/ coordination	Item 1	1.000	0.539	
	Item 2	1.030 (0.137)	0.609	< .001
	Item 3	1.058 (0.132)	0.610	< .001
	Item 4	1.073 (0.123)	0.677	< .001
Stressor – Decision-Making	Item 1	1.000	0.734	
	Item 2	0.816 (0.080)	0.700	< .001
	Item 3	0.256 (0.100)	0.171	.011
Stressors of teamwork	Communication	1.000	0.929	
	Supporting behaviour	0.920 (0.098)	0.904	< .001
	Leadership	0.688 (0.125)	0.879	< .001
	Shared Mental Models	1.066 (0.119)	0.893	< .001
	Organization/ coordination	0.893 (0.108)	0.958	< .001
	Decision-Making	1.054 (0.106)	0.826	< .001

Table A4.3 *Factor loadings of the CFA for resources of teamwork*

Latent Variables		Estimate (Std.Error)	Standardized	*p*
Resource – Communication	Item 1	1.000	0.570	
	Item 2	1.045 (0.130)	0.673	< .001
	Item 3	1.279 (0.163)	0.778	< .001
	Item 4	1.195 (0.183)	0.647	< .001
	Item 5	1.165 (0.162)	0.526	< .001
	Item 6	1.517 (0.227)	0.663	< .001
Resource – Supporting behaviour	Item 1	1.000	0.624	
	Item 2	1.080 (0.128)	0.681	< .001
	Item 3	1.049 (0.149)	0.443	< .001
	Item 4	0.860 (0.135)	0.473	< .001
	Item 5	0.649 (0.102)	0.578	< .001
Resource – Leadership	Item 1	1.000	0.141	
	Item 2	4.110 (2.085)	0.658	.049
	Item 3	3.062 (1.492)	0.432	.040
	Item 4	3.807 (2.020)	0.730	.060
Resource – Shared Mental Models	Item 1	1.000	0.618	
	Item 2	0.943 (0.134)	0.613	< .001
	Item 3	1.125 (0.150)	0.588	< .001
Resource – Organization/ coordination	Item 1	1.000	0.596	
	Item 2	0.596 (0.096)	0.393	< .001
	Item 3	0.708 (0.115)	0.528	< .001
Resources of teamwork	Communication	1.000	0.902	
	Supporting behaviour	1.135 (0.158)	0.958	< .001
	Leadership	0.279 (0.147)	0.834	.058
	Shared Mental Models	1.092 (0.165)	0.937	< .001
	Organization/ coordination	1.293 (0.203)	0.970	< .001

Table A4.4 *Factor loadings of the CFA for team flow*

Latent Variables		Estimate (Std.Error)	Standardized	*p*
Team flow	Item 1	1.000	0.544	
	Item 2	1.321 (0.140)	0.768	< .001
	Item 3	1.200 (0.136)	0.631	< .001
	Item 4	1.291 (0.138)	0.710	< .001
	Item 5	1.047 (0.136)	0.649	< .001
	Item 6	1.181 (0.147)	0.729	< .001
	Item 7	1.303 (0.135)	0.772	< .001
	Item 8	1.516 (0.159)	0.762	< .001
	Item 9	1.540 (0.162)	0.780	< .001
	Item 10	1.425 (0.151)	0.830	< .001
	Item 11	1.329 (0.138)	0.776	< .001
	Item 12	1.435 (0.150)	0.792	< .001

9.2 Appendix B: Supplementary Material – Study II

Table A5.1 *Rating using an adapted version of the Newcastle-Ottawa Quality assessment scale (adapted from Rotenstein et al., 2018)*

Study	Represen-tativeness of the sample	Sample size	Ascertain-ment of burnout	Ascertain-ment of flow	Quality of descriptive statistics reporting	Sum
Bakker & Geurts, 2004	1	1	1	0	1	4
Baumgarten et al., 2020	1	0	1	1	0	3
Demerouti et al., 2012	1	0	1	1	1	4
Kasa & Hassan, 2015	1	0	1	1	0	3
Kasa & Hassan, 2016	1	1	1	1	0	4
Kasa & Hassan, 2019	1	0	1	1	0	3
Lavigne et al., 2012 (Study 1)	0	0	1	1	1	3
Lavigne et al., 2012 (Study 2)	1	1	1	1	1	5
Ljubin-Golub et al., 2020	0.5	0	1	1	1	3.5
Mäkikangas et al., 2010	0.5	1	1	1	1	4.5
Martínez-Zaragoza et al., 2014	1	0	1	1	1	4
Martínez-Zaragoza et al., 2017	1	0	1	1	1	4
Mosing et al., 2018	1	1	1	1	0.5	4.5
Rodríguez-Sánchez, Schaufeli, et al., 2011	1	0	0.5	0	1	2.5
Schiefele et al., 2013	1	0	1	1	1	4
Xanthopoulou et al., 2018	1	0	1	1	1	4
Xie et al., 2019	1	1	1	1	1	5
Zito et al., 2016	0	0	1	1	1	3

1) Representativeness of the sample
   1 point: Population contained multiple specialties and/or multiple institutions
   0 points: Population contained a single specialty and a single institution

2) Sample size:
   1 point: Sample size was ≥300 participants
   0 points: Sample size was <300 participants

3) Ascertainment of burnout:
   1 point: Well described and/or validated measurement tool, e.g., the MBI
   0 points: Poorly described measurement tool of uncertain validity or non-validated single-question screening tool

4) Ascertainment of flow:
   1 point: Well described and/or validated measurement tool, e.g., the WOLF
   0 points: Poorly described measurement tool of uncertain validity or non-validated single-question screening tool or tools assessing another construct

5) Quality of descriptive statistics reporting:
   1 point: Reported descriptive statistics to describe the population (e.g., age, sex) with proper measures of dispersion (e.g., mean, standard deviation)
   0 points: Descriptive statistics were not reported, were incomplete, or did not include proper measures of dispersion

Note. This scale assesses quality in several domains: sample representativeness and size, ascertainment of burnout and flow, and statistical reporting quality.

Table A5.2 *Additional multifactorial results*

Source	Multifactorial Results
Demerouti et al., 2012	**Multilevel estimates** • EE at work (Y) ○ AB (X): Estimate = -0.09 ○ EN (X): Estimate = -0.19* ○ IM (X): Estimate = -0.08 ○ AB*recovery (X): -0.12 ○ EN*recovery (X): 0.34*** ○ IM*recovery (X): 0.09 • EE at bedtime (Y) ○ AB (X): Estimate = -0.04 ○ EN (X): Estimate = -0.16* ○ IM (X): Estimate = -0.13 ○ AB*detachment (X) = 0.09 ○ EN*detachment (X) = -0.26* ○ IM*detachment (X) = 0.14
Kasa & Hassan, 2015[a]	**Mediation** burnout symptoms (X) → flow (M) → OCB (Y): n.s
Kasa & Hassan, 2016	**Mediation** burnout symptoms (X) and socio-cultural factor (MO) → flow (Y): n.s.
Kasa & Hassan, 2019[a]	**Mediation** burnout symptoms (X) → flow (M) → work-family conflict (Y): 0.08, -0.12: n.s.
Lavigne et al., 2012 (Study 1)	**Path analysis** • flow (Y) ○ Harmonious passion (X): $\gamma = 0.58$*** ○ Obsessive passion (X): $\beta = -0.00$ • flow (X) ○ EE (Y): $\beta = -0.09$ ○ CY (Y): $\beta = -0.43$*** ○ RPA (Y): $\beta = -0.54$*** **Mediation *(Sobel test z-values)*** Harmonious passion (X) → flow (M) → EE (Y): -0.89 Harmonious passion (X) → flow (M) → CY (Y): 3.79*** Harmonious passion (X) → flow (M) → RPA (Y): 4.84***

Table A5.2 (continued)

Source	Multifactorial Results
Lavigne et al., 2012 (Study 2)	**Cross-lag panel model** • flow at T2 (Y) ○ Harmonious passion at T1: γ = 0.32*** ○ Obsessive passion at T1: γ = 0.09 ○ flow at T1: γ = 0.50*** • flow at T2 (X) ○ EE at T2 (Y): β = -0.31*** ○ CY at T2 (Y): β = -0.34*** ○ RPA at T2 (Y): β = -0.55*** • flow at T1 did not predict burnout symptoms at T2 **Mediation *(Sobel test z-values)*** Harmonious passion at T1 (X) → flow at T2 (M) → EE at T2 (Y): -3.84*** Harmonious passion at T1 (X) → flow at T2 (M) → CY at T2 (Y): -4.16*** Harmonious passion at T1 (X) → flow at T2 (M) → RPA at T2 (Y): -4.53*** Obsessive passion at T1 (X) → flow at T2 (M) → EE at T2 (Y): -1.30 Obsessive passion at T1 (X) → flow at T2 (M) → CY at T2 (Y): -1.29 Obsessive passion at T1 (X) → flow at T2 (M) → RPA at T2 (Y): -1.32
Ljubin-Golub et al., 2020	**Mediation** Autonomous motivation (X) → flow (M) → burnout symptoms (Y) Indirect effect: β = - 0.44*** Teachers' autonomy support (X) → autonomous motivation (M1) → flow (M2) → burnout symptoms (Y) Indirect effect: β = - 0.31*** flow (M2) → burnout symptoms: -0.59***
Mäkikangas et al., 2010	**Moderation** Job resources (X) and EE (MO) → flow (Y): n.s. **Latent growth curve modeling** Initial level of EE → initial level of flow: β = -0.31*** and initial level for job resources: β = -0.39*** Initial level of EE → latent change factors of flow and job resources: n.s.
Martínez-Zaragoza et al., 2017	**Structural and measurement model[b]** Associations between flow, health, burnout symptoms and approach coping are described Flow as antecedent model: flow (X) → RPA (Y) = -0.16**

Table A5.2 (continued)

Source	Multifactorial Results
Mosing et al., 2018	**Genetic and environmental influences** r_g (flow proneness; emotional exhaustion) = -.58 (genetic correlation) r_e(flow proneness; emotional exhaustion) = -.23 (environmental correlation) *r*(flow proneness; emotional exhaustion) = -.23 (controlled for shared genetic and familial factors)***
Schiefele et al., 2013	**Structural equation model[b]** Exogenous variables: self-efficacy, didactic interest, educational interest and subject interest Outcomes: EE, RPA, CY, enjoyment and flow • flow (Y) ○ EE (Y): n.s. ○ CY (Y) = n.s ○ RPA (Y) = n.s.
Xanthopoulou et al., 2018	**Multilevel path analysis** • flow (M) ○ deep acting (X)= 0.13** ○ surface acting (X) = -0.09* ○ need for recovery (Y) = -0.25** • EE (M) ○ deep acting (X)= -0.13* ○ surface acting (X) = 0.24*** ○ need for recovery (Y): 0.45*** **flow & EE: Unstandardized estimates = -0.07*** **
Zito et al., 2016	**Mediation** • flow (M) ○ Job resources (X): 0.49 ○ Job demands (X): -0.27 ○ EX (Y): -0.70 Indirect effects: Job resources (X)→ flow (M) → EX (Y): Estimate = -0.34*** Job demands (X)→ flow (M) → EX (Y): Estimate = 0.19***

Note. EE = emotional exhaustion, CY = cynicism, RPA = reduced personal accomplishment, EX = exhaustion, AB = absorption, EN = enjoyment, IM = intrinsic motivation, T = timepoint, X = independent variable, M = mediator, MO = Moderator, Y = dependent variable, OCB = organizational citizenship behavior, n.s. = not significant (statistical parameters not given).

[a] The studies may have been based on the same data.

[b] Due to the large number of factors considered in the models, a presentation of all interrelationships has been omitted

* $p < .05$; ** $p < .01$; *** $p < .001$

For reasons of clarity and comprehensibility, the labels of the various subscales were harmonized and reversed recoded where appropriate.

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9.3 Appendix C: Supplementary Material – Study III

Table A6.1 *Flow Frequency Scale (Bartzik, Aust, & Peifer, 2021; Bartzik & Peifer, 2023)*

Im Folgenden finden Sie eine Reihe von Fragen zu **Ihrem Erleben bei beruflichen Tätigkeiten**. Bitte geben Sie an, wie häufig oder selten Sie das jeweilige Erleben in den **letzten zwei Wochen bei der Arbeit** hatten. **Wie häufig erlebten Sie es in den letzten zwei Wochen bei der Arbeit, dass…**		
Below you will find a number of questions **about your daily work**. Please rate "how often" or "rarely" you have had the experience in the **last two weeks**. **How often have you experienced in the last two weeks at work, that …**		
German Items	**English Items**	**Scale**
…Sie im Tun Freude empfanden.	...you felt joy in doing.	1 = *Nie*, 2 = *selten*, 3 = *manchmal*, 4 = *eher häufig*, 5 = *häufig*, 6 = *(fast) immer* 1 = *Never*, 2 = *Almost never*, 3 = *Sometimes*, 4 = *Often*, 5 = *Very Often*, 6 = *(Almost) always*
…Sie ganz in einer Tätigkeit aufgingen.	...you were completely absorbed in an activity.	
… Sie genau im richtigen Maß gefordert waren.	...you were challenged in just the right degree.	
…Sie Ihr Tun genießen konnten.	...you could enjoy what you were doing.	
…Sie Ihre Fähigkeiten optimal einsetzen konnten.	...you could use your skills to the optimal extent.	
…die Anforderungen wie für Sie gemacht waren.	...the requirements were as made for you.	
... sich Ihr Tun gut anfühlte.	...your doing felt good.	
... Sie sich mühelos konzentrieren konnten.	...you could concentrate effortlessly.	
... Sie im Tun an nichts anderes dachten.	...you thought of nothing else when you were doing.	

Note. In this study the German items were used. As the scale is still under development, the items may differ slightly from other published versions (Bartzik, Aust, & Peifer, 2021).

Table A6.2 *Intercorrelations of the study variables*

Variable	1	2	3	4	5	5.1	5.2	5.3	6	6.1	6.2	6.3	7	7.1	7.2	7.3	8	9	10	11
1 Age	-																			
2 BMI	.24**	-																		
3 PHQ-9 (t_0)	.03	.05	-																	
4 PHQ-9 (t_1)	.01	.07	.70**	-																
5 MBI-GS – total score (t_0)	.03	-.02	.76**	.62**	-															
5.1 EE (t_0)	.07	.06	.78**	.64**	.90**	-														
5.2 RPA (t_0)	-.03	-.12	.44**	.38**	.63**	.38**	-													
5.3 CY (t_0)	-.01	-.03	.57**	.43**	.87**	.65**	.43**	-												
6 MBI-GS – total score (t_1)	.02	.10	.61**	.70**	.68**	.65**	.45**	.54**	-											
6.1 EE (t_1)	.04	.15*	.64**	.71**	.60**	.67**	.28**	.41**	.89**	-										
6.2 RPA (t_1)	.04	.03	.39**	.39**	.51**	.32**	.66**	.42**	.64**	.35**	-									
6.3 CY (t_1)	-.02	.03	.42**	.50**	.60**	.51**	.33**	.57**	.86**	.61**	.49**	-								
7 Flow (t_1) – total score	-.02	-.00	-.51**	-.61**	-.60**	-.51**	-.49**	-.48**	-.78**	-.64**	-.64**	-.67**	-							
7.1 DSB (t_1)	-.03	-.02	-.43**	-.52**	-.52**	-.43**	-.46**	-.41**	-.70**	-.55**	-.59**	-.60**	.93**	-						
7.2 AB (t_1)	.03	.04	-.57**	-.61**	-.61**	-.54**	-.47**	-.45**	-.71**	-.59**	-.57**	-.58**	.91**	.73**	-					
7.3 EN (t_1)	-.05	-.03	-.46**	-.56**	-.57**	-.47**	-.46**	-.48**	-.78**	-.63**	-.61**	-.68**	.95**	.84**	.81**	-				
8 HCC (pg/mg)	.03	.23*	-.03	.01	-.04	-.03	-.08	.00	.01	.02	-.01	-.01	-.00	.02	-.03	.01	-			
9 HCN (pg/mg)	.01	.10	-.03	-.07	-.06	-.07	-.04	-.04	-.06	-.07	-.07	.00	.08	.07	.07	.07	.69**	-		
10 lnRMSSD (m^2)	-.40**	-.19**	-.07	-.06	-.09	-.17*	.02	-.02	-.08	-.10	-.01	-.02	.06	.05	.09	.04	-.10	-.03	-	
11 lnHF-HRV(m^2)	-.41**	-.16*	-.07	-.08	-.09	-.17*	-.03	-.00	-.09	-.10	-.03	-.03	.04	.01	.09	.02	-.15	-.15	.93**	-

Note. * $p < .050$; ** $p < .010$ (two-tailed); Pairwise deletion was used. AB = absorption, BMI = Body-Mass-Index, CY = cynicism; DSB = perceived demand-skill balance, EE = emotional exhaustion, EN = enjoyment, HCC = hair cortisol concentration, HNC = hair cortisone concentration, MBI-GS = Maslach Burnout Inventory - General Survey, PHQ-9: Patient Health Questionnaire (9 items), RPA = reduced personal accomplishment.

Table A6.3 *Results of the multiple regression with the flow total score as dependent variable and the HCC as predictor (model 2; n = 378)*

	b [CI]	SE_b	β	*t*	*p* (p_{boot})
Age	-0.01	0.01	-0.06	-1.19	.233 (.233)
	[-0.02, 0.01]				
Sex	0.03	0.13	0.01	0.23	.821 (.806)
	[-0.23, 0.28]				
Hair coloring	0.08	0.14	0.03	0.61	.545 (.559)
	[-0.19, 0.34]				
HCC (t_1)	0.04	0.03	0.21	1.61	.108 (.112)
	[-0.01, 0.10]				
HCC² (t_1)	-0.00	0.00	-0.24	-1.81	.071 (.067)
	[-0.00, 0.00]				

Note. 95% confidence interval (CI) and standard error estimated by BCa bootstrapping with 5,000 BCa samples. HCC = hair cortisol concentration.

Table A6.4 *Results of the multiple regression with the flow total score as dependent variable and the HCN as predictor (model 3; n = 376)*

	b [CI]	SE_b	β	*t*	*p* (p_{boot})
Age	-0.01	0.01	-0.07	-1.41	.160 (.143)
	[-0.02, 0.00]				
Sex	0.11	0.14	0.04	0.73	.464 (.445)
	[-0.17, 0.39]				
Hair coloring	0.08	0.14	0.04	0.61	.544 (.552)
	[-0.20, 0.36]				
HCN (t_1)	0.01	0.02	0.10	0.60	.549 (.543)
	[-0.03, 0.06]				
HCN² (t_1)	0.00	0.00	-0.03	-0.19	.851 (.854)
	[-0.00, 0.00]				

Note. 95% confidence interval (CI) and standard error estimated by BCa bootstrapping with 5,000 BCa samples. HNC = hair cortisone concentration.

Table A6.5 *Results of the multiple regression with the flow total score as dependent variable and the lnRMSSD as predictor (model 4; n = 207)*

	b [CI]	*SE_b*	β	*t*	*p (p_{boot})*
Age	-0.01	0.01	-0.04	-0.55	.586 (.570)
	[-0.02, 0.01]				
Sex	0.09	0.17	0.03	0.48	.631 (.629)
	[-0.25, 0.43]				
Alcohol consumption (yes/no) (t_0)	0.78	0.30	0.19	2.71	.007 (.009)
	[0.20, 1.35]				
Smoking (yes/no) (t_0)	0.13	0.28	0.03	0.45	.657 (.646)
	[-0.40, 0.67]				
BMI (t_0)	0.00	0.02	0.00	0.05	.962 (.961)
	[-0.03, 0.04]				
lnRMSSD (t_0)	0.10	0.15	0.05	0.63	.532 (.512)
	[-0.20, 0.41]				

Note. 95% confidence interval (CI) and standard error estimated by BCa bootstrapping with 5,000 BCa samples. BMI = Body Mass Index.

Table A6.6 *Results of the multiple regression with the flow total score as dependent variable and the lnHF-HRV as predictor (model 5; n = 207)*

	b [CI]	*SE_b*	β	*t*	*p (p_{boot})*
Age	-0.01	0.01	-0.05	-0.68	.495 (.480)
	[-0.02, 0.01]				
Sex	0.09	0.17	0.04	0.49	.624 (.617)
	[-0.25, 0.43]				
Alcohol consumption (yes/no) (t_0)	0.78	0.30	0.19	2.71	.007 (.009)
	[0.19, 1.36]				
Smoking (yes/no) (t_0)	0.12	0.27	0.03	0.40	.689 (.674)
	[-0.42, 0.66]				
BMI (t_0)	0.00	0.02	-0.00	-0.01	.990 (.991)
	[-0.03, 0.03]				
lnHF-HRV (t_0)	0.02	0.07	0.02	0.22	.826 (.822)
	[-0.12, 0.16]				

Note. 95% confidence interval (CI) and standard error estimated by BCa bootstrapping with 5,000 BCa samples. BMI = Body Mass Index.

Table A6.7 *Cross-sectional partial correlations between flow and burnout symptoms (controlled for PHQ-9)*

Flow	Burnout Symptoms			
	Total score	EE	RPA	CY
Total score	-.63**	-.36**	-.54**	-.52**
DSB	-.54**	-.29**	-.49**	-.45**
AB	-.49**	-.29**	-.46**	-.39**
EN	-.64**	-.39**	-.51**	-.55**

Note. ** $p < .001$ (one-tailed). Correlations are controlled for age, sex and PHQ-9 (t_1). Pairwise deletion was used. EE = emotional exhaustion, CY = cynicism, RPA = reduced personal accomplishment, DSB = perceived demand-skill balance, AB = absorption, EN = enjoyment.

Table A6.8 *Results of the multiple regression with flow total score as dependent variable, the MBI-GS total score as predictor, and PHQ-9 as additional control variable (n = 217)*

	b [CI]	SE_b	β	*t*	*p* (p_{boot})
Age	-0.00	0.01	-0.02	-0.27	.786 (.784)
	[-0.02, 0.01]				
Sex	0.14	0.13	0.06	1.01	.312 (.279)
	[-0.12, 0.39]				
PHQ-9 (t_0)	-0.36	0.21	-0.16	-1.81	.072 (.082)
	[-0.76, 0.03]				
MBI-GS total score (t_0)	-0.52	0.09	-0.48	-5.56	< .001 (< .001)
	[-0.69, -0.34]				

Note. 95% confidence interval (CI) and standard error estimated by BCa bootstrapping with 5,000 BCa samples. MBI-GS = Maslach Burnout Inventory - General Survey, PHQ-9 = Patient Health Questionnaire (9 items).

Table A6.9 *Results of the multiple regression with perceived demand-skill balance as dependent variable and the MBI-GS total score as predictor*

	Model 1 (without PHQ-9, *n* = 223)					Model 2 (with PHQ-9, *n* = 217)				
	b [CI]	SE_b	β	*t*	*p* (p_{boot})	*b [CI]*	SE_b	β	*t*	*p* (p_{boot})
Age	-0.00	0.01	-0.02	-0.42	.673	-0.00	0.01	-0.03	-0.48	.630
	[-0.02, 0.01]				(.680)	[-0.02, 0.01]				(.651)
Sex	0.06	0.15	0.02	0.39	.698	0.11	0.16	0.04	0.64	.526
	[-0.26, 0.36]				(.692)	[-0.21, 0.40]				(.511)
PHQ-9 (t_0)						-0.22	0.25	-0.09	-0.95	.342
						[-0.69, 0.24]				(.381)
MBI-GS total score (t_0)	-0.62	0.06	-0.53	-9.11	< .001	-0.54	0.10	-0.45	-4.97	< .001
	[-0.74, -0.49]				(< .001)	[-0.74, -0.33]				(< .001)

Note. 95% confidence interval (CI) and standard error estimated by BCa bootstrapping with 5,000 BCa samples. MBI-GS = Maslach Burnout Inventory - General Survey, PHQ-9 = Patient Health Questionnaire (9 items).

Table A6.10 *Results of the multiple regression with absorption as dependent variable and the MBI-GS total score as predictor*

	Model 1 (without PHQ-9, *n* = 223)					Model 2 (with PHQ-9, *n* = 217)				
	b [CI]	SE_b	β	*t*	*p* (p_{boot})	*b [CI]*	SE_b	β	*t*	*p* (p_{boot})
Age	0.00	0.01	0.02	0.36	.718	0.00	0.01	0.02	0.41	.686
	[-0.01, 0.02]				(.700)	[-0.01, 0.02]				(.687)
Sex	0.04	0.13	0.02	0.28	.776	0.12	0.13	0.05	0.85	.395
	[-0.22, 0.29]				(.757)	[-0.14, 0.37]				(.354)
PHQ-9 (t_0)						-0.66	0.21	-0.28	-3.31	.001
						[-1.05, -0.26]				(.001)
MBI-GS total score (t_0)	-0.66	0.06	-0.61	-11.28	< .001	-0.42	0.09	-0.38	-4.53	< .001
	[-0.77, -0.56]				(< .001)	[-0.60, -0.24]				(< .001)

Note. 95% confidence interval (CI) and standard error estimated by BCa bootstrapping with 5,000 BCa samples. MBI-GS = Maslach Burnout Inventory - General Survey, PHQ-9 = Patient Health Questionnaire (9 items).

Table A6.11 *Results of the multiple regression with enjoyment as dependent variable and the MBI-GS total score as predictor*

	Model 1 (without PHQ-9, *n* = 223)					Model 2 (with PHQ-9, *n* = 217)				
	b [CI]	SE_b	β	*t*	*p* (p_{boot})	*b [CI]*	SE_b	β	*t*	*p* (p_{boot})
Age	-0.00 [-0.02, 0.01]	0.01	-0.03	-0.54	.591 (.588)	-0.00 [-0.02, 0.01]	0.01	-0.03	-0.60	.551 (.548)
Sex	0.17 [-0.12, 0.45]	0.14	0.06	1.11	.270 (.245)	0.21 [-0.09, 0.49]	0.15	0.08	1.32	.189 (.176)
PHQ-9 (t_0)						-0.20 [-0.64, 0.22]	0.22	-0.08	-0.91	.362 (.378)
MBI-GS total score (t_0)	-0.66 [-0.77, -0.54]	0.06	-0.57	-10.34	< .001 (< .001)	-0.59 [-0.78, -0.39]	0.10	-0.51	-5.78	< .001 (< .001)

Note. 95% confidence interval (CI) and standard error estimated by BCa bootstrapping with 5,000 BCa samples. MBI-GS = Maslach Burnout Inventory - General Survey, PHQ-9 = Patient Health Questionnaire (9 items).

Table A6.12 *Results of the multiple regression with the flow total score as dependent variable and the MBI-GS sub-dimensions as predictors*

	Model 1 (without PHQ-9, *n* = 219)					Model 2 (with PHQ-9, *n* = 213)				
	b [CI]	SE_b	β	*t*	*p* (p_{boot})	*b [CI]*	SE_b	β	*t*	*p* (p_{boot})
Age	-0.00 [-0.02, 0.01]	0.01	-0.02	-0.35	.726 (.739)	-0.00 [-0.02, 0.01]	0.01	-0.02	-0.44	.663 (.666)
Sex	0.09 [-0.16, 0.34]	0.13	0.04	0.66	.507 (.472)	0.12 [-0.13, 0.38]	0.13	0.05	0.86	.393 (.352)
PHQ-9 (t_0)						-0.40 [-0.83, 0.04]	0.22	-0.18	-1.92	.056 (.066)
EE (t_0)	-0.24 [-0.36, -0.12]	0.06	-0.30	-4.04	< .001 (< .001)	-0.14 [-0.30, 0.01]	0.08	-0.17	-1.79	.075 (.069)
RPA (t_0)	-0.41 [-0.57, -0.25]	0.08	-0.32	-5.24	< .001 (< .001)	-0.37 [-0.53, -0.21]	0.08	-0.28	-4.47	< .001 (< .001)
CY (t_0)	-0.11 [-0.24, 0.02]	0.07	-0.14	-1.88	.062 (.088)	-0.11 [-0.24, 0.02]	0.07	-0.14	-1.78	.076 (.091)

Note. 95% confidence interval (CI) and standard error estimated by BCa bootstrapping with 5,000 BCa samples. CY = cynicism, EE = emotional exhaustion, PHQ-9 = Patient Health Questionnaire (9 items), RPA = reduced personal accomplishment.

Table A6.13 *Results of the multiple regression with perceived demand-skill balance as dependent variable and the MBI-GS sub-dimensions as predictors*

	Model 1 (without PHQ-9, *n* = 219)					Model 2 (with PHQ-9, *n* = 213)				
	b [CI]	SE_b	β	*t*	*p* (p_{boot})	*b [CI]*	SE_b	β	*t*	*p* (p_{boot})
Age	-0.01	0.01	-0.04	-0.62	.535	-0.01	0.01	-0.04	-0.70	.482
	[-0.02, 0.01]				(.558)	[-0.02, 0.01]				(.490)
Sex	0.05	0.15	0.02	0.32	.752	0.08	0.16	0.03	0.44	.658
	[-0.24, 0.35]				(.739)	[-0.22, 0.37]				(.641)
PHQ-9 (t_0)						-0.30	0.25	-0.12	-1.21	.227
						[-0.80, 0.21]				(.235)
EE (t_0)	-0.20	0.08	-0.23	-2.91	.004	-0.12	0.09	-0.14	-1.37	.174
	[-0.34, -0.05]				(.009)	[-0.30, 0.03]				(.142)
RPA (t_0)	-0.44	0.09	-0.31	-4.83	< .001	-0.41	0.09	-0.28	-4.21	< .001
	[-0.62, -0.27]				(< .001)	[-0.59, -0.23]				(< .001)
CY (t_0)	-0.11	0.08	-0.13	-1.61	.108	-0.12	0.08	-0.13	-1.62	.106
	[-0.27, 0.05]				(.159)	[-0.28, 0.04]				(.152)

Note. 95% confidence interval (CI) and standard error estimated by BCa bootstrapping with 5,000 BCa samples. CY = cynicism, EE = emotional exhaustion, PHQ-9 = Patient Health Questionnaire (9 items), RPA = reduced personal accomplishment.

Table A6.14 *Results of the multiple regression with absorption as dependent variable and the MBI-GS sub-dimensions as predictors*

	Model 1 (without PHQ-9, *n* = 219)					Model 2 (with PHQ-9, *n* = 213)				
	b [CI]	SE_b	β	*t*	*p* (p_{boot})	*b [CI]*	SE_b	β	*t*	*p* (p_{boot})
Age	0.00	0.01	0.03	0.46	.646	0.00	0.01	0.02	0.39	.698
	[-0.01, 0.02]				(.646)	[-0.01, 0.02]				(.704)
Sex	0.08	0.13	0.03	0.59	.557	0.13	0.13	0.05	0.90	.369
	[-0.16, 0.32]				(.505)	[-0.13, 0.38]				(.323)
PHQ-9 (t_0)						-0.63	0.23	-0.27	-3.03	.003
						[-1.06, -0.15]				(.008)
EE (t_0)	-0.32	0.06	-0.40	-5.39	< .001	-0.17	0.08	-0.20	-2.15	.033
	[-0.43, -0.20]				(< .001)	[-0.34, -0.01]				(.048)
RPA (t_0)	-0.39	0.08	-0.30	-5.00	< .001	-0.34	0.08	-0.25	-4.10	< .001
	[-0.55, -0.23]				(< .001)	[-0.49, -0.18]				(< .001)
CY (t_0)	-0.05	0.06	-0.06	-0.84	.400	-0.03	0.06	-0.04	-0.55	.587
	[-0.17, 0.07]				(.400)	[-0.15, 0.09]				(.571)

Note. 95% confidence interval (CI) and standard error estimated by BCa bootstrapping with 5,000 BCa samples. CY = cynicism, EE = emotional exhaustion, PHQ-9 = Patient Health Questionnaire (9 items), RPA = reduced personal accomplishment.

Table A6.15 *Results of the multiple regression with enjoyment as dependent variable and the MBI-GS sub-dimensions as predictors*

	Model 1 (without PHQ-9, *n* = 219)					Model 2 (with PHQ-9, *n* = 213)				
	b [CI]	SE_b	β	*t*	*p* (p_{boot})	*b [CI]*	SE_b	β	*t*	*p* (p_{boot})
Age	-0.01	0.01	-0.04	-0.72	.474	-0.01	0.01	-0.05	-0.79	.430
	[-0.02, 0.01]				(.489)	[-0.02, 0.01]				(.439)
Sex	0.15	0.14	0.05	0.94	.348	0.17	0.15	0.06	1.05	.297
	[-0.13, 0.42]				(.318)	[-0.12, 0.46]				(.263)
PHQ-9 (t_0)						-0.28	0.24	-0.12	-1.22	.225
						[-0.73, 0.20]				(.237)
EE (t_0)	-0.20	0.07	-0.23	-3.03	.003	-0.13	0.09	-0.15	-1.49	.138
	[-0.32, -0.07]				(.003)	[-0.30, 0.03]				(.134)
RPA (t_0)	-0.40	0.09	-0.29	-4.62	< .001	-0.36	0.09	-0.26	-3.99	< .001
	[-0.57, -0.22]				(< .001)	[-0.54, -0.18]				(< .001)
CY (t_0)	-0.18	0.07	-0.20	-2.63	.009	-0.18	0.07	-0.21	-2.63	.009
	[-0.32, -0.02]				(.020)	[-0.33, -0.03]				(.016)

Note. 95% confidence interval (CI) and standard error estimated by BCa bootstrapping with 5,000 BCa samples. CY = cynicism, EE = emotional exhaustion, PHQ-9 = Patient Health Questionnaire (9 items), RPA = reduced personal accomplishment.