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THE PROCRASTINATING PHD STUDENT: A LATENT PROFILE ANALYSIS

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ABSTRACT

Aim/Purpose	Little is known about procrastination in PhD students, as most research focuses on undergraduate students. While there have been several efforts to identify different types of academic procrastinators in undergraduates, no study has attempted to identify different procrastination types in PhD students. Additionally, most of the studies that found different procrastination types in undergraduates did not research how these types differ regarding procrastination antecedents, excluding important information about the characteristics of these types.
Background	The present study addresses this problem by identifying different procrastination types of PhD students based on reasons for academic procrastination. Furthermore, more information about these types was gathered by analyzing differences in procrastination antecedents (depression, imposter self-concept, self-worth, mindfulness, self-efficacy, impulsivity, conscientiousness, neuroticism, emotion regulation, rumination).
Methodology	A total of 401 German-speaking PhD students from over 100 fields were included in the analysis. An online questionnaire was used to collect data. First, we used a reason for academic procrastination questionnaire to run a latent profile analysis to identify different academic procrastinators. Second, we used multivariate analysis of variance (MANOVA) to analyze differences between the types of academic procrastinators based on reasons for procrastination and antecedents of procrastination. More precisely, we used Tuckman's procrastination scale, depressiveness in a non-clinical setting scale, imposter self-concept

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	questionnaire, Rosenberg's self-esteem scale, mindfulness attention and awareness scale, self-efficacy scale, impulsivity scale, big five inventory, emotion regulation questionnaire, and the response style questionnaire.
Contribution	The present study provides a deeper insight into academic procrastination among PhD students. Additionally, the identification of procrastination types is based on a variety of reasons for academic procrastination rather than solely procrastination, which adds a new perspective. Validation of the found types helps gain a clearer insight into how these types differ from each other. In line with previous research with undergraduate students, we could show that the high procrastinating types also show significantly higher impulsivity, neuroticism, and rumination and significantly lower self-worth. Contrary to undergraduate students, we could not find any significant differences between the types with regard to emotion regulation. These findings contribute to a clearer picture of procrastinating PhD students and their challenges.
Findings	We identified six different procrastination types (moderate procrastinator type (n = 121), insecure type (n = 81), productive type (n = 79), externalizing type (n = 51), strong procrastinator type (n = 25), internalizing type (n = 38) based on the reasons for academic procrastination. The productive and externalizing types seem to be the most functional, and the strong procrastinator and internalizing types are the most dysfunctional. The latter showed significantly worse expressions of procrastination, depression, imposter self-concept, self-worth, mindfulness, self-efficacy, impulsivity, conscientiousness, neuroticism, and rumination. The moderate procrastinator and insecure types appear to fall somewhere between the high-functioning and low-functioning types in terms of analyzed procrastination antecedents.
Recommendations for Practitioners	Practitioners should use the reasons for academic procrastination questionnaire (FGAP-P) for assessment. PhD students who strongly agree to procrastinate due to study-related competencies, personality-related variables, beliefs, and task characteristics are the most at risk. Practitioners should be aware that these individuals are more likely to suffer from procrastination, depressive symptoms, negative self-view (imposter syndrome, low self-worth/self-efficacy), impulsivity, and rumination. Interventions that target the reduction of these symptoms should be recommended or applied by practitioners.
Recommendations for Researchers	When utilizing latent profile analysis to explore procrastination types in PhD students concurrently, assessing procrastination antecedents associated with the PhD completion process is recommended. This simultaneous assessment is pivotal as it facilitates a comprehensive understanding of the different procrastination types, allowing for the identification of shared characteristics and distinctions among them. By adopting this approach, researchers can move beyond mere classification based solely on type membership and gain deeper insights into the nuances of procrastination types and behaviors.
Impact on Society	The findings provide crucial insights for supervising and/or consulting PhD students. Having knowledge about different procrastination types in PhD students helps identify at-risk individuals. Using our findings, interventions could especially target these at-risk individuals, therefore reducing procrastination and enhancing well-being and productivity in PhD students.
Future Research	Future research could use longitudinal research designs to assess the stability of procrastination types found over time using real-time data within an experience sampling methods framework. This could help to minimize biases and gain

deeper insights not only about interindividual but also intraindividual differences. Furthermore, cross-cultural studies should be conducted to unveil similarities and differences between cultures regarding procrastination and procrastination types.

Keywords procrastination, PhD students, latent profile analysis

INTRODUCTION

"I'll start/continue writing my dissertation tomorrow" might be a thought most PhD candidates have repeatedly during their PhD completion process and is representative of the phenomenon called procrastination. Research on procrastination among PhD candidates is of high importance given the role these individuals play in driving innovation and creating knowledge across academic disciplines. Procrastination can slow down progress toward PhD completion and can occur in all phases of the PhD process. Different studies have examined the occurrence, effects, and consequences of procrastination in the academic context.

Steel (2007) shows that procrastination is an issue for undergraduate students. Unfortunately, procrastination also prevails at the PhD level (Afzal & Jami, 2018; He, 2017; Herut & Gorfu, 2024). Brahmbhatt (2021) shows that procrastination in PhD candidates correlates positively with exhaustion, stress, and worry and negatively with productivity. In turn, perceived stress in PhD candidates directly lowers the satisfaction with the PhD program and increases the intention to quit the PhD (Feizi et al., 2024). Soares et al. (2020) add evidence to that dynamic, as they showed that procrastination and subjective well-being predict satisfaction with the PhD program and, in turn, completion of it.

Unfortunately, doctoral students' time-to-degree completion has increased constantly since the 1960s (Agbonlahor, 2022). Although the dropout rates in PhD programs vary significantly across disciplines, it is clear that, on average, dropout rates in PhD programs are higher than in Bachelor or Master programs (Wollast et al., 2018). While many factors play into the non-completion of a PhD, procrastination is a significant negative factor. Additionally, Beutel et al. (2016) have shown that procrastination is associated with mental health problems. In fact, one in two PhD candidates experiences psychological distress, and the prevalence of mental health challenges in PhD candidates is significantly higher compared to highly educated employees or undergraduate/graduate master's level students (Levecque et al., 2017). Therefore, procrastination and its effects are also highly relevant for PhD candidates.

Not studying procrastination in PhD students to inform interventions to decrease procrastination would be detrimental, as procrastination also has severe financial costs for the university or an organization (Nguyen et al., 2013). Unfortunately, only a few studies focus solely on procrastination among PhD candidates. However, the focus has been on the prevalence of procrastination in PhD candidates or the relationship between procrastination and factors that have a moderating or mediating effect on procrastination (Herut & Gorfu, 2024; Wu & He, 2022). Even though those research approaches are highly important, none have tried to identify different types of academic procrastinators among PhD candidates. In the present study, we identify different types of procrastinating PhD students and characterize these types by procrastination antecedents.

THEORETICAL BACKGROUND

DEFINITIONS, THEORIES, AND ANTECEDENTS OF PROCRASTINATION

Steel (2007) defines procrastination as one's voluntary delay of an intended course of action despite being worse off because of that delay. Klingsieck (2013a) agrees with this definition and emphasizes

the difference between procrastination and strategic delay, also known as active procrastination. Even though strategic delay also occurs voluntarily, it does not involve negative consequences for the individual. On the contrary, dysfunctional procrastination is defined as the decision to postpone a task despite being aware of its dysfunctionality. The dysfunctionality of procrastination has been shown in various studies. Procrastination is associated with poorer academic performance (Kim & Seo, 2015), well-being (Pychyl & Sirois, 2016), higher levels of stress, depression, anxiety, fatigue, and reduced life satisfaction (Beutel et al., 2016). A vast majority of students (75%) see themselves as habitual procrastinators (Steel, 2007).

Various theories have been developed and empirically tested to explain procrastination. Among the prominent theories are emotion regulation theory (e.g., Tice & Bratslavsky, 2009), temporal motivation theory (e.g., Steel & König, 2006; Steel et al., 2018), and a combination of those two called the temporal decision model (e.g., Zhang et al., 2019). Emotion regulation theory postulates that procrastination is a strategy for short-term mood repair. The negative appraisal of a task on hand can lead to the presence of aversive emotions or the loss of positive emotions associated with an alternative task. Procrastination then serves the function of avoiding aversive emotions or prolonging positive emotions, resulting in short-term mood repair yet being worse off later because of that delay. This disjunction between the present and future self is part of emotion regulation theory and has been well-studied (Sirois, 2014). Temporal motivation theory postulates that an individual's motivation to work on a task is determined by the value of the task result, the expectation to successfully complete the task, the time between the work put in until the outcome, and one's sensitivity to delay. If individuals value an outcome (high value) and believe in themselves that they can achieve this outcome (high expectancy), motivation to work will likely be high. This dynamic would be empowered even more if the time between the achievement of the goal and the work put in is short and the individual's sensitivity to delay is low. In turn, the probability of procrastinating rises dramatically if the value of an outcome is low, the expectancy of goal completion is low, there is a big gap between the present moment and the time of possible goal completion, and the individual is prone to distractibility. The temporal decision model tries to combine emotion regulation and temporal motivation theory. An individual evaluates the timing of a task based on a comparison between the value of the possible outcome in the present versus the future. Procrastination is the result if an individual values the delay of a task higher than the costs of the postponement. Furthermore, procrastination is a result of an interaction between the ability of delayed gratification and task aversiveness. In summary, there are various theoretical frameworks for procrastination, each having a solid empirical backbone. In addition, the mentioned theories do not contradict each other but complement each other.

A part of the procrastination research understands procrastination as a time management problem, which could be understood in the context of temporal motivation theory. The assumption is that people are unable to plan and organize their tasks appropriately, which then results in procrastination. In particular, many intervention studies focus on the goal of enhancing time management skills in individuals. van Eerde (2016) and Häfner et al. (2014) showed that relatively short time management training was useful in reducing procrastination in students. Pychyl and Sirois (2016) broaden this view and discuss why individuals show this type of self-regulatory failure. They understand procrastination mainly as a dysfunctional way of emotion regulation within the emotion regulation theory. For example, a student might be faced with a difficult writing task that evokes unpleasant feelings, such as frustration, anxiety, and feelings of insufficiency. Postponing the task on hand results in the disappearance or reduction of these negative affects, which subsequently negatively reinforces this process. In such a situation, the procrastinating person prioritizes short-term mood-repair over long-term goals. Sirois and Kitner (2015) tested this assumption using a meta-analytical approach. They showed that maladaptive coping when faced with emotional distress (e.g., behavioral disengagement) is positively associated with procrastination and that the relationship between procrastination and stress is mediated by maladaptive coping. Additionally, Eckert et al. (2016) showed that the enhancement of emotion-regulation skills results in a reduction of procrastination, which supports the perspective mentioned above.

Negative affect can be the result of different ongoing states and traits in an individual. Procrastination research has examined different antecedents of procrastination, which we will display shortly. Beswick et al. (1988) showed that self-esteem was responsible for significant variance in procrastination. Additionally, depression and anxiety showed a positive correlation with procrastination. Different studies could also validate the results showing the significant influence of depression and anxiety on procrastination (Ozer et al., 2014; Spada et al., 2006). In addition to self-esteem, self-efficacy was also found to be negatively related to procrastination (Cerino, 2014; Hall et al., 2019). Individuals with high perfectionistic tendencies were also found to have higher scores on measures of procrastination (Çapan, 2010; G. L. Flett et al., 1995; Saddler & Sacks, 1993). Perfectionism is related to imposter syndrome, which is defined by people having high levels of self-doubt even though they experience recurring successes. Maftei et al. (2021) showed that this belief is associated with high levels of psychological distress and procrastination. Psychological distress from procrastination can also be a result of dysfunctional cognitive processes such as rumination and worrying and low levels of mindfulness. Sirois and Tosti (2012) showed that procrastination was linked to low levels of mindfulness and that mindfulness mediates the relationship between procrastination and stress. Schutte and del Pozo de Bolger (2020) replicated those findings, and A. L. Flett et al. (2016) expanded those results, showing that procrastination is additionally associated with high levels of rumination and low levels of self-compassion. When looking at the big five personality traits, low levels of conscientiousness and high levels of neuroticism are related to procrastination (Steel, 2007; Watson, 2001). As depicted, procrastination has many antecedents that play an important role in evoking negative emotions, which can lead to procrastination if functional emotion regulation strategies are not available for the individual.

Types of Procrastinators

While one research field attempts to understand the antecedents of procrastination better, another part of the research deals with the question of whether there are different types of academic procrastinators. The identification of different types within a larger group based on patterns of responses to multiple variables is a very common research objective in the field of psychology. For example, Fosnacht et al. (2018) researched first-year students' time use and found four types (balanced, involved, partiers, and parents) of time usage. Ning and Downing (2014) found four types of self-regulated learning strategy orientations in university students (competent self-regulated learners, cognitive-oriented self-regulated learners, behavioral-oriented self-regulated learners, and minimal self-regulated learners). In general, finding distinct types can have different advantages. Uncovering types existing within a population can help identify unique characteristics and patterns. Additionally, antecedents and predictors contributing to type membership can be identified, as well as outcomes associated with each type. Finally, practical implications may arise from identifying different subgroups with unique characteristics as the development of tailor-made interventions becomes possible.

In the following, we will give a short overview of studies that have attempted to identify different types of academic procrastinators while focusing on the more recent studies. For a detailed review of the history of studies looking for procrastination types, we recommend the review by Steel and Klingsieck (2016). Rothblum et al. (1986) conducted one of the first studies to identify different types of procrastinators in university students. They identified high and low procrastinators and showed that high procrastinators had significantly more test anxiety, state anxiety, and anxiety-related symptoms. In addition, they were more likely to attribute success in exams to external unstable factors than low procrastinators were. Lay (1987) identified two types of procrastinators high in neuroticism. One type was working on personal projects that were indicated as high stress and high difficulty and showed low progress. The second type showed a low level of energy level and need-achievement while working on low-difficulty and low-stress projects. As already seen in these two studies, researchers often use different variables to identify different types, which makes it difficult to compare those different types. To resolve this challenge, Gueorguieva (2011) reviewed previous findings. Following Schouwenburg's (2004) understanding, Gueorguieva (2011) argued that most types explain

procrastination by the presence or absence of neuroticism and extraversion. Gueorguieva (2011) suggests four procrastination types (daydreamer, avoidant postponer, anxious idealist, and people pleaser) based on a review of the literature. "Daydreamers" are high in extraversion and are described as easily distracted or bored by the task at hand; therefore, they retreat into other activities or fantasies. "Avoidant postponers" are high in neuroticism and low in extraversion; they do not obey rules and have a high need for autonomy, which is evident in the avoidance of feared autonomy-limiting tasks. "Anxious idealists" are high on neuroticism. They fear failure and judgment and set very high goals, even though they lack an action plan. The "people pleaser" type scores high on neuroticism and extraversion, as well as agreeableness. They want to feel connected to others and, therefore, struggle to say no, which often leads to overcommitment, resulting in procrastination. In conclusion, the identification of various types of academic procrastinators, ranging from high and low procrastinators to nuanced categories as depicted by Gueorguieva (2011), underscores the complexity of procrastination behaviors and highlights the importance of considering personality traits such as neuroticism and extraversion in understanding and addressing procrastination tendencies among students.

More recent studies have taken advantage of modern quantitative approaches to identify different types of academic procrastinators. Grunschel et al. (2013) used their self-developed *reasons for academic procrastination questionnaire* and identified different types of academic delayers in university students using latent profile analysis. They found four different types (inconspicuous type, successful pressure-seeking type, worried/anxious type, and discontent with studies type). Grunschel et al. (2013) highlight that the "worried/anxious" and "discontent with studies" types show significantly higher scores on procrastination than the first two types. Rebetez et al. (2015) used a cluster-analytic approach to identify four types in university students (unregulated, emotional, regulated/low motivated, and highly regulated). They label the "unregulated" and "emotional type" as procrastinators. The "unregulated type" shows high impulsivity and scores high on inappropriate cognitive emotion regulation strategies while showing low self-esteem and low extrinsic identified motivation. The "emotional type" also shows low self-esteem and scored high on inappropriate cognitive emotion regulation strategies while maintaining medium perseverance and medium extrinsic identified motivation. Using cluster analysis, Rozental et al. (2015) examined procrastination in a group of treatment-seeking people. They identified five subgroups: mild, average, well-adjusted, severe, and primarily depressed procrastinators. Özberk and Türk Kurtça (2021) applied latent profile analysis in a cross-cultural setting to identify different procrastination types in a Turkish and international university student sample. The results showed three types for the Turkish student sample (tending to enjoyable works, neither lessons nor other works, and ambition for academic success) and two types for the international student sample (academic procrastination tending to enjoyable works and prioritizing academic tasks). Liu (2024) researched procrastination types in the corporate world and identified three types (lowest, lower, and high procrastination groups). She found life satisfaction, age, and the presence or absence of children to be predictive of group membership. While some procrastination-type studies are difficult to compare with each other due to different focal points, others are not. In line with previous findings depicted above, both Grunschel et al. (2013) and Rebetez et al. (2015) describe high procrastinating types, which could be understood as high in neuroticism and impacted by dysfunctional emotional regulation strategies.

Differences Between PhD and Undergraduate Students

Almost all of the above-mentioned studies used undergraduate student samples to identify different procrastination types. Even though undergraduate students constitute the majority of the population in the academic context, PhD students seem to fall short in their representation in scientific studies. An argument could be made that insights gained from undergraduate students could be transferred to doctoral candidates. However, we observe two significant structural differences that we would like to outline at this point. One major difference is the importance of supervisory guidance in the PhD process. While supervisory guidance also plays a role for undergraduate students, undergraduate students most of the time do not collaborate with the same supervisor within the same research project,

which has been happening for doctoral candidates over the years. Therefore, problems occurring in the relationship with the supervisor are less significant. This is why the relationship between an undergraduate student and supervisor could be seen as less intensive and personal than that for doctoral candidates. Sverdlik et al. (2018) argued that supervisory guidance is one of the major external factors within a PhD. Past and recent research shows that supervisory guidance has a significant impact on PhD students' satisfaction, persistence, productivity, and success in the completion of the PhD (Corsini et al., 2022; Gube et al., 2017).

We see another major difference between doctoral candidates and undergraduate students regarding additional work tasks that apply especially to the employment situation of PhD students in Europe, which may differ from that of their counterparts in the US/Canada. An analysis of the job situation of 3,000 doctoral candidates in Germany showed that 77% had part-time employment as a junior researcher (Hauss et al., 2012). Within this position, half of the time could be used for working on the PhD project, whereas the other half is required to be used for other responsibilities (e.g., other research projects, teaching, administration). Additional work tasks have been shown to have a negative influence on procrastination (Ferrari & Tice, 2000). In addition, 70% of doctoral candidates work overtime. These working conditions lead to reduced social interactions and leisure time, burnout, and depressive symptoms (Galdino et al., 2016; Longfield et al., 2006; Uqdah et al., 2009). Additional non-PhD-related work tasks are not a risk factor exclusively for German PhD students. Capó et al. (2007) showed that frequent contact between doctoral candidates and supervisors has a negative impact on academic performance. This counterintuitive finding was explained by the fact that these additional contacts lead to more work tasks unrelated to the PhD project, which in turn leads to worse academic performance. As for German PhD students, Swedish PhD students are often employed either at the university or a company. They also reported problems balancing between non-PhD-related work tasks and PhD-related work tasks, which often leads to a significant delay in the PhD project (Sundström et al., 2016). van Rooij et al. (2019) could show this for a Dutch sample, as doctoral candidates in the Netherlands are most often employed. The additional non-PhD-related workload had a major negative impact on satisfaction, being on schedule with one's own PhD, and intention to quit. In summary, the context in which most PhD projects are occurring brings an additional workload, which can negatively impact procrastination and hence influence the completion of the PhD.

PhD candidates can be seen as research professionals. Therefore, it is helpful to look at the research that examines procrastination in the workplace context, even though the prevalence of studies is low (van Eerde, 2016). Procrastination could be shown to be a dysfunctional behavior in the workplace context, correlating negatively with work performance and having high costs for companies (Klingsieck, 2013b; Metin et al., 2016; Wan et al., 2014). Metin et al. (2018) show that low work engagement is associated with higher work procrastination. Additionally, Köse and Metin (2018) show that transformational leadership and organizational citizenship were associated with less procrastination. On the other hand, leader procrastination is associated with follower behavior, e.g., organizational citizenship behavior and deviant behavior (Legood et al., 2018). With regards to employment status, Nguyen et al. (2013) show that high levels of procrastination at work are associated with shorter durations of employment and a greater probability of a part-time rather than a full-time position. This finding could be especially relevant for German PhD candidates, as 77% only have a part-time position and a short contract duration (see above). Additionally, Wang et al. (2021) identified procrastination as an obstacle to effective remote work during the COVID-19 pandemic. As seen, procrastination is not just a problem for undergraduate students but also occurs in the workplace context and has a negative impact on the individual and organizational levels.

Present Study

As shown, many studies identified different types of procrastinators, yet those studies could be criticized methodologically. First, a large part of the research (Liu, 2024; Özberk & Türk Kurtça, 2021; Rozental et al., 2015) creates type membership by using solely one measure of procrastination, which

assesses the procrastination tendency. While this is important information, we argue that type membership should not be solely based on procrastination. For example, Grunschel et al. (2013) solved this challenge using their self-developed *reasons of academic procrastination questionnaire* to identify four different types. Type membership was not only based on procrastination tendencies but also on different reasons for academic procrastination. Second, most studies mentioned above only characterize their procrastination types with a limited set of variables that are linked to procrastination. For example, Rebetez et al. (2015) used impulsivity, emotion regulation, self-esteem, and extrinsic identified motivation. Although these variables play an important role in procrastination, there are many more antecedents of procrastination. Including them in the description of the types would help to get a more detailed picture of procrastination types and could be used subsequently to develop tailor-made interventions. Third, most procrastination studies employ undergraduate students in their studies, as depicted above. It is questionable whether the types found are also valid for other samples or if there might be any differences.

Our study has the goal of exploring different types of academic procrastinators based on reasons for procrastination in an under-researched group in the procrastination field of PhD students. Beyond that, we want to characterize these types using different procrastination antecedents. We designed this study to answer the following two research questions:

1. What different procrastination types, based on reasons for procrastination, can be found in PhD students?
2. How do these types differ from each other regarding the antecedents of procrastination?

METHOD

SAMPLE

To reach as many PhD candidates as possible, the sample was recruited through advertisements in newsletters from graduate schools and foundations that support PhD candidates. In total, we contacted nine graduate schools and four foundations that support PhD candidates and asked them to share our mail and the link to our online study, which we prepared in advance for them to send out. All PhD candidates who speak German and have not yet completed their PhD were eligible to participate in our study. The total sample consisted of 401 doctoral students enrolled in a PhD program at a German university (female = 267; male = 132; other gender identity = 2). The imbalance in gender distribution is picked up in the results and discussion. The youngest PhD candidate was 22, the oldest was 59 years of age, and nearly all the participants were in the age range between 22 and 30 (72.8%). Participants were enrolled in over 100 different fields, with most in psychology (14.5%), law (6%), education (5.5%), biology (5%), and sociology (4.5%). Compared with data from the German Federal Statistical Office (2020), there was an overrepresentation of doctoral students from social sciences (psychology, education, and sociology). We assume that PhD candidates from social sciences were more motivated to participate in the study because of closer thematic proximity to a social science study than PhD candidates from thematically more distant non-social sciences disciplines. Each participant could choose compensation between a 10€ Amazon voucher or a 10€ donation to the German Red Cross.

PROCEDURE

Participants were able to access the study through an online link. The study language was German. Initially, they were informed in terms of informed consent that the aim of the study was to gain a deeper understanding of procrastination and the reasons behind it among doctoral candidates. In addition, they were informed that participation in the study would be anonymized, ensuring that no inference could be made to personally identifiable information. Furthermore, participants were informed that they could withdraw from the study at any time without providing reasons. Subsequently, sociodemographic variables (e.g., age, gender, employment status, PhD subject) were initially

collected before the participants answered items from the following questionnaires and scales. The median completion time was 27:08 minutes, and the dropout rate was 22.48%.

MEASURES

Due to the complex nature of procrastination and its interconnectedness with different psychological traits and constructs, we decided to investigate a multitude of psychological variables. Procrastination is primarily seen as a self-regulation failure (Rozental & Carlbring, 2014). As shown in the theoretical background section, procrastination, as one form of self-regulation failure, is linked to low mental well-being (e.g., depression), dysfunctional self-concepts (e.g., imposter self-concept, low self-esteem, low self-efficacy), personality traits (neuroticism and conscientiousness) and dysfunctional coping mechanisms (e.g., emotion suppression, rumination). Therefore, we see it as necessary to assess these variables to gain a comprehensive understanding of identified procrastination types and their characteristics. In addition, including a wide variety of linked psychological variables is helpful in the development of diagnostic approaches and tailored interventions with the aim of reducing procrastination in PhD students.

Reasons for academic procrastination. We used the reasons for academic procrastination questionnaire (FGAP-P, Gross & Hansen, 2023*)*. We want to outline this questionnaire more precisely at this point because it is the basis of the analysis in this study. The questionnaire comprises five scales (study-related competencies, personality-related variables, beliefs, task characteristics, and university framework conditions). "Study-related competencies" (Cronbach's $\alpha = .86$) address the reasons for procrastination because of deficits in time management, self-motivation, endurance, and research competence (e.g., "I procrastinate because I cannot motivate myself to start working on my tasks."). The scale "personality-related variables" (Cronbach's $\alpha = .91$) assesses reasons for procrastination, such as perfectionism, anxiety, uncertainty regarding the PhD, and low self-confidence (e.g., "I'm procrastinating because I doubt my abilities."). The convictions to only being able to work under pressure and have had previous success despite having delayed relevant tasks are subsummized by the scale "beliefs" (Cronbach's $\alpha = .90$) (e.g., "I procrastinate because I work best under pressure during my PhD."). The scale "task characteristics" (Cronbach's $\alpha = .85$) addresses procrastination because of tasks being aversive or complex (e.g., "I procrastinate because I find my tasks boring."). The last scale, "university framework conditions" (Cronbach's $\alpha = .84$), assesses whether someone is procrastinating because the supervisor is not available for feedback or missing deadlines and goal agreements (e.g., "I procrastinate because my supervisor is not easily accessible when I have questions."). In total, the FGAP-P consists of 47 items to be answered on a 6-point Likert scale.

Procrastination. The Tuckman Procrastination Scale (Tuckman, 1991) captures a person's dysfunctional tendency to postpone tasks. It consists of 16 items (Cronbach's $\alpha = .71$) measuring procrastination using a 5-point Likert scale (e.g., "I am an incurable time waster."). The scale was originally developed for students, which is why some items were adapted for doctoral students.

Depressiveness. This scale (Mohr & Müller, 2004) measures psychological impairment of well-being and was developed for a non-clinical context. It consists of 8 items (e.g., "I have to really push myself to do something."). The response format is a 7-point Likert scale (Cronbach's $\alpha = .83$).

Impostor Self-Concept. The Impostor Self-Concept Questionnaire (Rohrmann et al., 2020) measures a person's tendency to (1) doubt their own competencies despite objective indicators of success and (2) attribute accomplishments externally. It consists of 15 items (Cronbach's $\alpha = .94$) that are answered on a 4-point Likert scale (e.g., "Although I have already achieved significant successes, I am afraid that I will not be able to meet the expectations of others in the future.").

Self-Esteem. To assess a person's self-esteem, we used a German version of Rosenberg's self-esteem scale (von Collani & Herzberg, 2003). The scale includes 10 items (e.g., "On the whole, I am satisfied with myself."). The response format is a 4-point Likert scale (Cronbach's $\alpha = .90$).

Mindfulness. We used the German version of the Mindfulness Attention and Awareness Scale (Michalak et al., 2008) to measure dispositional mindfulness. The scale consists of 15 items (e.g., "It seems I am "running on automatic," without much awareness of what I am doing." – reverse coded) that are being answered on a 6-point Likert scale (Cronbach's $\alpha = .89$).

Self-Efficacy. We used a short German version of the self-efficacy scale (Beierlein et al., 2012; originally by Jerusalem & Schwarzer, 1999), which captures individual competence expectations to deal with difficulties and obstacles in daily life. The scale consists of three items (e.g., "I can handle most problems well on my own.") which are being answered on a 5-point Likert scale (Cronbach's $\alpha = .85$).

Impulsivity. To assess impulsive behavior, we used Kovaleva et al.'s (2014) short scale. This scale measures four facets of impulsive behavior (urgency, intention, perseverance, and risk appetite). Eight items (e.g., "I sometimes do things to cheer myself up that I later regret.") are answered on a 5-point Likert scale (Cronbach's $\alpha = .72$).

Neuroticism and Conscientiousness. To measure neuroticism and conscientiousness, we used the German version of the short version of the Big Five Inventory (Rammstedt & John, 2005). Conscientiousness (Cronbach's $\alpha = .70$) and neuroticism (Cronbach's $\alpha = .78$) are measured using four items. The response format is a 5-point Likert scale.

Emotion Regulation. We used the German version of the Emotion Regulation Questionnaire (Abler & Kessler, 2009) to assess two strategies for regulating one's own emotions. Six items (Cronbach's $\alpha = .85$) measure cognitive reappraisal (e.g., "When I want to feel more positive emotion, I change the way I'm thinking about the situation.") and four items (Cronbach's $\alpha = .75$) measure expressive suppression (e.g., "When I am feeling negative emotions, I keep them to myself."). The response format is a 7-point Likert scale.

Rumination. To measure different ways of rumination, we used the German version of the response style questionnaire (Bürger & Kühner, 2007), which consists of three scales. First, symptom-related rumination (e.g., "When I feel sad or down, I think about how exhausted I feel.") is measured by eight items (Cronbach's $\alpha = .85$). Second, self-related rumination (e.g., "When I feel sad or down, I think about how alone I feel.") is measured by seven items (Cronbach's $\alpha = .81$) and third distraction (e.g., "When I feel sad or down, I help someone else with something to distract myself.") is measured by eight items (Cronbach's $\alpha = .77$). The response format is a 4-point Likert scale.

Statistical Analysis

To identify different types of doctoral students, a latent profile analysis (LPA) (Muthén & Muthén, 2015) was carried out using the five scales of the reasons for academic procrastination questionnaire (FGAP-P, Gross & Hansen, 2023). The variables included were designed as mandatory questions, which is why there were no missing data.

The aim of LPA was to identify hidden types of doctoral students in the dataset. The method summarizes the characteristics of individuals who are similar in the characteristics included and differ from other types in these characteristics (Ferguson et al., 2020). The latently modeled factor scores from confirmatory factor analyses (e.g., Brown, 2006) of the scales used for the LPA were used in the analyses. Factor scores were chosen instead of manifest mean values because the observed responses are thus weighted in the calculation, and the residuals of the manifest items are excluded. The confirmatory factor analyses and LPA were performed using the Mplus 7.2 program (Muthén & Muthén, 2015). To analyze significant differences between the types regarding procrastination-relevant antecedents, we used multivariate analysis of variance (MANOVA) in IBM SPSS 29. More precisely, we tested whether there were any significant differences between the types regarding procrastination, depressiveness, impostor self-concept, self-esteem, mindfulness, self-efficacy, impulsivity, conscientiousness, neuroticism, emotion regulation, and rumination. In addition, we used post hoc tests to

obtain a clearer understanding of the significant differences between the types. Tukey's HSD (or Games-Howell) was used if the assumption of homoscedasticity was satisfied (or violated).

RESULTS

The five scales of the FGAP-P (Gross & Hansen, 2023), "study-related competencies," "personality-related variables," "beliefs," "task characteristics," and "university framework conditions" were used to create the different types. Seven models were estimated (see Table 1) and compared with each other with regard to the frequently considered FIT indices (AIC, BIC, SABIC, Entropy, p-LMR, BLRT) (Geiser, 2011; Marsh et al., 2009). The characteristic values of AIC and SABIC decrease with increasing type solutions. The six- and seven-type solutions are, therefore, the lowest and differ only marginally when considering the SABIC values (e.g., Spurk et al., 2020). With the lowest value for the three-type solution, the BIC indicates this as the selection. The entropy value is marginally higher for the two-types solution than for the six-type solution, both being the highest with a value of approximately 0.80 (Celeux & Soromenho, 1996). The p-LMR test is significant for both the four- and seven-types solutions (n vs. n-1 profiles), which is in favor of the three- and six-types solutions. The BLRT, on the other hand, only shows that the model quality does not improve significantly from a seven-type solution compared to a solution with one type less, which speaks in favor of a six-type solution. Based on the parameters presented above, in particular the BLRT, and the interpretability of the types (Geiser, 2011), a six-type solution was chosen.

Table 1. Results overview of the latent profile analysis

Types	Number of parameters	AIC	BIC	SABIC	Entropy	*p* LMR	BLRT	< 1%
2	16	3353.65	3417.56	3366.79	0.80	.000	.000	0
3	22	3296.80	3384.67	3314.86	0.74	.001	.000	0
4	28	3289.22	3401.06	3312.21	0.70	1.00	.024	0
5	34	3267.35	3403.14	3295.26	0.75	.000	.000	0
6	40	3240.11	3399.86	3272.94	0.80	.032	.000	0
7	46	3233.64	3417.37	3271.41	0.79	.144	.088	0

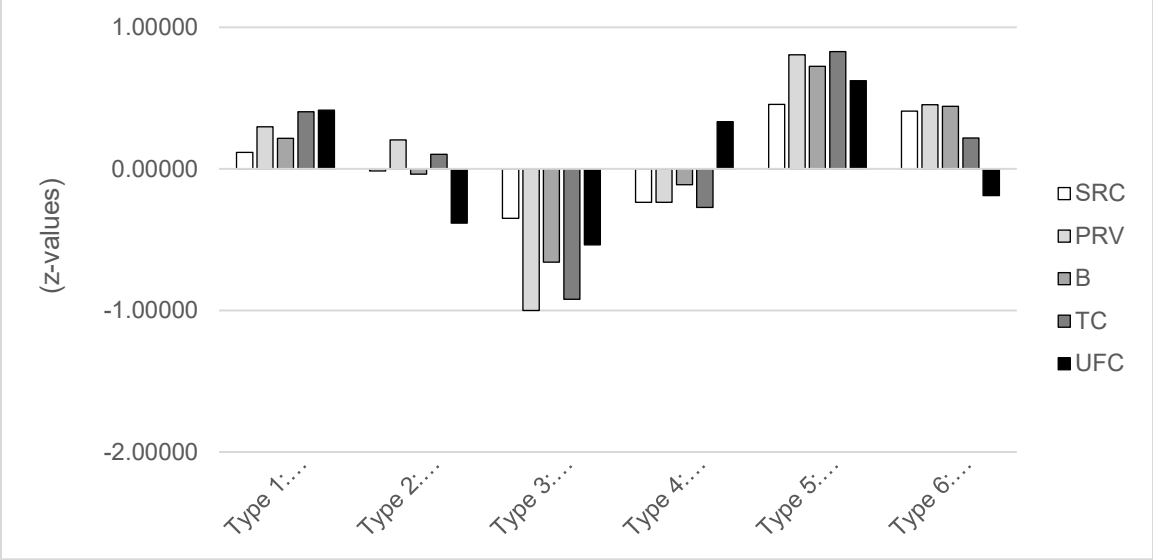
Note. N = 401; AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; SABIC = sample size adjusted BIC; *p* LMR = Lo-Mendell-Rubin likelihood ratio test; BLRT = bootstrap-likelihood-ratio-test for *n* vs. *n*-1 types; <1% indicates the number of identified types that make up less than 1% of the sample.

In the following section, we describe the types and their expressions on the five scales of the FGAP-P. Positive expressions indicate that individuals of this type procrastinate because of the reasons presented in the scale. Vice versa, negative expressions indicate that the individuals belonging to this type do not procrastinate because of these reasons presented in the scale. Figure 1 shows every one of the six types of solutions within the latent profile analysis. Before delving deeper into the six-type solution, we want to quickly present the three-type solution, which we rejected (see below), to allow a comparison with the six-type solution, which we chose due to a superior fit to the data. The first type (please note that the order does not imply any importance or priority) in the three-type solution has strong negative expressions on all five scales, indicating that individuals belonging to this group are, in general, more productive. The second type has moderate to strong positive expressions on all five scales, indicating that individuals in this group tend to procrastinate because of the reasons presented. The third type has a very mild positive expression on all five scales, being between the first two types. We chose a six-type solution over a three-type solution because the latter would have resulted in a loss of significant information and detail, given the complexity of the data captured by five distinct scales. Additionally, the six-type solution demonstrated superior fit to the data across multiple fit indices and offered enhanced model quality and interpretability. In the following, we describe the six types and their expression on the five scales of the FGAP-P. Additionally, we give the types names to

make further communication easier. It should be noted that there is no standardized process for giving the types names (Ferguson et al., 2020). However, the names of the types should not be misleading, and each should be representative of the type's characteristics, especially in contrast to the other types.

In the six-type solutions, the first type (n = 121) has moderate positive expressions on all five scales. We call the individuals in this type the *moderate procrastinator type,* as none of the five scales stands out in this type. The second type (n = 87) has low positive expressions on the scale "personality-related variables" and moderate negative expressions on the scale "university framework conditions"; therefore, these individuals belong to the *insecure type*. We decided to name this type insecure because the "personality-related variables" stand out. The third type (n = 79) has strong negative expressions on all scales; therefore, we call this type the *productive type*. The fourth type (n = 51) has moderate negative expressions on all scales except the scale "university framework conditions," where the individuals in this type show a moderate positive expression; therefore, we named it the *externalizing type*. We decided to do so to contrast the differences with the *productive type*, as the *externalizing type* differs from the productive type. Individuals in the *externalizing type* appear to procrastinate only when external reasons compel them to do so. The fifth type (n = 25) shows strong positive expressions on all the scales; therefore, we call this the *strong procrastinator type*. The sixth type (n = 38) shows moderate positive expressions on all of the scales except for the "university framework conditions" scale, where the individuals in this type show a moderate negative expression; therefore, we named it the *internalizing type*. Just as with the *productive type* and the *externalizing type*, we have chosen the name *internalizing type* here to contrast with the *strong procrastinator type*, thus illustrating that individuals in this type primarily perceive the root of procrastination as internal rather than external conditions.

In terms of gender distribution, we wanted to test whether men and women are equally distributed across the types. Chi-square tests show that there is a correlation between the type and gender ($\chi^2(5) = 16.6$; $p = 0.005$). Females were significantly more common in the *externalizing type* (80%) and the *insecure type* (74%) than in the *productive* (51%) and *internalizing type* (59%). The *moderate procrastinator type* (69%) and the *strong procrastinator type* (68%) were between the extremes. The two individuals who did not identify as male or female were not included in the analysis.



Note. SRC = study-related competencies; PRV = personality-related variables; B = beliefs; TC = task characteristics; UFC = university framework conditions.

Figure 1. z-values of the six identified types

TYPE VALIDATION

Table A1 in the Appendix presents the descriptive statistics for the validation variables for each of the six types, and Figure A1 in the Appendix shows the type validation in a graphical form. The results from a MANOVA are displayed, including post hoc comparisons. There were significant differences between the types for all validation variables except for emotion regulation (suppression and reappraisal) and the tendency to distract oneself when feeling sad.

The extent of procrastination was the lowest for the *productive type*, as it significantly differed for all other identified types. The *strong procrastinator* and *internalizing types* show significantly higher procrastination than all other types. In addition, the *moderate procrastinator type* showed significantly higher procrastination than the *insecure*, *productive*, and *externalizing type*. In addition, the *insecure type* showed significantly higher expressions of procrastination behavior than the *productive* and *externalizing types*.

With regard to depression in a non-clinical setting, the *productive type* showed significantly lower scores than all other types. The *moderate procrastinator* and *internalizing type* have significantly more depressive symptoms than the *insecure* and *externalizing type*.

We found that the *productive type* has a significantly smaller self-view of being an impostor than the *moderate procrastinator*, *insecure*, *strong procrastinator*, and *internalizing type*. In addition, the *strong procrastinator* and *internalizing types* have a significantly stronger impostor self-concept than the *externalizing type*.

The *productive type* indicates significantly higher self-esteem than the *moderate procrastinator*, *insecure*, *strong procrastinator*, and *internalizing type*. In addition, the *externalizing type* has significantly higher feelings of self-esteem than the *strong procrastinator* and *internalizing types*.

Regarding mindfulness, note that the mindfulness awareness and attention questionnaire is reversely coded, meaning that low values indicate high levels of mindfulness. The *productive type* differs significantly from the *moderate procrastinator, externalizing, strong procrastinator*, and internalizing types, meaning that it has significantly higher levels of mindfulness. The *productive type* also has significantly higher self-efficacy than the *moderate procrastinator*, *insecure*, *strong procrastinator*, and *internalizing type*. In addition, the *productive type* has significantly lower impulsivity than the *strong procrastinator* and *internalizing type*.

In the context of the Big Five, differences in conscientiousness and neuroticism were analyzed. The *productive* and *externalizing types* are significantly more conscientious than the other types. In addition, the *moderate procrastinator* and *insecure type* are significantly more conscientious than the *strong procrastinator* and *internalizing type*. Regarding levels of neuroticism, the *productive type* has a significantly lower degree of neuroticism than the *moderate procrastinator* and internalizing type.

Individuals from the *moderate procrastinator type* ruminate about their symptoms significantly more when they feel sad than those from the *insecure, productive*, and *externalizing type*, but significantly less than those from the *strong procrastinator type*. The *insecure type* ruminates significantly more than the *productive type*. The *insecure, productive*, and *externalizing type* ruminate about their symptoms significantly less than the *strong procrastinator* and *internalizing type* when feeling sad and down. The habit of ruminating about negative self-aspects when feeling sad is significantly lower for individuals in the *productive type* compared with the *moderate procrastinator* and *internalizing type*.

In summary, we find six distinct types of PhD procrastinators. The *productive* and *externalizing types* are characterized by significantly higher expressions of procrastination-protecting antecedents and significantly lower expressions of procrastination-elevating antecedents. Contrary to the *strong procrastinator* and *internalizing types,* the mentioned expressions are reversed. The *moderate* and *insecure* types lay between those two extremes.

DISCUSSION

The present study aimed to identify distinct types of procrastination based on reasons for procrastination and to characterize these types through antecedents of procrastination. A total of six types could be found that showed significant differences in the quantity of procrastination antecedents. These results help gain a clearer insight into how doctoral candidates differentiate from one another regarding reasons for procrastination. Additionally, the characterization of these types through antecedents of procrastination helps us understand which types are at the highest risk and, therefore, are the main subpopulation in need of interventions aimed at reducing procrastination.

Seeming to not be in need of interventions are two of the six types, the *productive* and *externalizing types*. The *productive type* disagrees with procrastinating because of all the reasons presented in the FGAP-P. In addition, the *externalizing type* disagrees, but to a lesser degree than the *productive type*. Doctoral candidates of this type report procrastination only because of reasons connected to university framework conditions, such as not receiving feedback from the supervisor or a lack of deadlines. The results of the latent profile analysis are backed up by the results of the MANOVA with post hoc comparisons. Both the *productive* and *externalizing types* show low procrastination, depression, imposter-self-concept, and symptom-oriented rumination but high self-worth and conscientiousness. However, the *productive* and *externalizing types* can also be differentiated from one another. First, the *productive type* showed significantly lower levels of procrastination and depression and significantly higher levels of mindfulness than the *externalizing type*. Second, the *productive type* is significantly superior to the other types in terms of self-efficacy, impulsivity, neuroticism, and self-related rumination when no significant difference can be identified between the *externalizing type* and other types. Overall, the data suggests that both types, compared to the other types, show a high degree of functioning on procrastination antecedents.

On the contrary, the *strong procrastinator* and *internalizing types* seem to need interventions aimed at reducing procrastination because they have significantly higher levels of procrastination than all other types. They show high levels of depression, impostor self-concept, symptom-oriented rumination, and impulsivity but low levels of self-worth, mindfulness, self-efficacy, and conscientiousness. Other than the *productive* and *externalizing types,* the *strong procrastinator* and *internalizing types* do not show any significant differences in any of the analyzed procrastination antecedents. However, the *internalizing type* is worse off than the *strong procrastinator type* because the *internalizing type* also shows significantly higher values for depression and neuroticism compared to other types, whereas the *strong procrastinator type* does not. This pattern could be explained by the difference in the reasons for procrastination. The *strong procrastinator type* procrastinates because of all the reasons mentioned in the FGAP-P (study-related competencies, personality-related variables, beliefs, task characteristics, and university framework conditions). The *internalizing type* shows a comparable pattern but disagrees with procrastinating because of external reasons in the context of university framework conditions. The absence of external reasons can be a threat to one's self-worth because failure in proceeding with one's own work cannot be externally attributed (Sherman & Cohen, 2006). This argument is only valid when there is a real difference in the number of external reasons between those two groups. Another explanation is that the *internalizing type* generally has a stronger tendency to attribute failure internally than the *strong procrastinator type*. Therefore, the *internalizing type* might be unable to perceive external reasons for one's own procrastination.

Finally, the *moderate procrastinator* and *insecure type* lie between the two extremes of the high-functioning *productive/externalizing type* and the low-functioning *strong procrastinator/internalizing type* regarding some procrastination antecedents (procrastination, depression, conscientiousness, symptom-related rumination). The *moderate procrastinator type* has a modest positive expression on all five scales of the FGAP. In contrast, the *insecure type* only shows a modest positive expression on "personality-related variables" and a negative expression on "university framework condition." Regarding the procrastination antecedents, these two types can be mainly differentiated by procrastination, depression, and

symptom-related rumination, as the *moderate procrastinator type* shows a significantly higher degree of the just mentioned antecedents.

In the present study, the gender distribution is not equal (females = 267 vs. males = 132 vs. diverse = 2). We attribute this to the fact that the vast majority of PhD candidates hail from disciplines (psychology, law, education, biology, and sociology) where women are disproportionately represented (Destatis, 2024). Accordingly, it is not surprising that this study had more female participants than male participants. Additionally, women were significantly more common in the low *procrastinating*, *externalizing,* and *insecure types*. There was not a significant overrepresentation of women in the high procrastinating, *strong procrastinator,* and *internalizing types*, which is in line with previous research showing that women tend to procrastinate less than men (Nguyen et al., 2013).

The findings from the present study are in line with existing theories. As the emotion regulation theory of procrastination states, procrastination is a dysfunctional way of regulating negative affect. Our findings mostly support this theoretical understanding. As shown, the *strong procrastinator* and *internalizing types* are significantly more depressed, have a more negative self-view (e.g., imposter-self-concept, low self-worth), and show more symptom-related rumination compared to less procrastinating types, such as the *productive* or *externalizing type*. Per definition, these constructs are connected to more negative affect while wanting to work on a task, increasing the risk to procrastinate to regulate the negative affect. Surprisingly and inconsistent with emotion-regulation theory, there are no significant differences regarding emotion-regulation strategies (suppression and cognitive reappraisal). We expected a higher degree of dysfunctional suppression and a lower degree of functional cognitive reappraisal in the higher procrastinating types. This finding suggests that these emotion-regulation strategies seem to be different from procrastination, which also serves as a dysfunctional way of regulating emotions. Temporal motivation theory and the temporal decision model are also supported by our findings. Two important components of those theories are the expectancy of being able to accomplish a task (e.g., self-efficacy) and the sensitivity to delay (e.g., impulsivity). As seen, the *productive type* has significantly higher self-efficacy than all other types except the *externalizing type*. Regarding impulsivity, the highest procrastinating types (*strong procrastinator* and *internalizing type*) show significantly higher levels of impulsivity than the *productive type*. With regard to the presented exception in emotion regulation, our data support depicted procrastination theories.

In the following, we compare our findings to those of former studies trying to identify different procrastination types. It should be noted that it is not expedient to compare whether former studies have found similar types, as each study uses a different basis for identifying different procrastination types. On the other hand, it is useful to compare whether the types that have higher degrees of procrastination show similarities or differences regarding procrastination antecedents. Rothblum et al. (1986) showed that high procrastinating university students, compared to low procrastinators, showed more test/state anxiety and also anxiety-related symptoms. Lay's (1987), Gueorguieva's (2011), and Schouwenburg's (2004) findings and conceptualizations also show high procrastinators to be high in neuroticism. In addition, Grunschel et al. (2013) describe their high procrastinating "worried/anxious type" as high in neuroticism. Our findings are perfectly in line with these findings. First, the *internalizing* and *moderate procrastinator types* show significantly higher neuroticism and self-related rumination, which is highly associated with anxiety/neuroticism (Taylor & Snyder, 2021). Additionally, symptom-related rumination is significantly higher in the high-procrastinating types compared to the low-procrastinating types in our sample. Furthermore, we see similarities but also differences with the findings of Rebetez et al. (2015). Similar to their high procrastinating "unregulated" and "emotional type," our *strong procrastinator type* and *internalizing type* show significantly higher impulsivity and lower self-worth than the *productive type*. Interestingly, their high procrastinating types show a higher level of inappropriate cognitive emotion regulation strategies, yet we could not find any significant differences between our types regarding emotion regulation strategies. Overall, the similarities between PhD and undergraduate students seem to outweigh the differences. Yet, the scarcity of research with PhD candidates is too big to generalize our findings. Furthermore, our research also provides new

information by incorporating reasons for academic procrastination. Individuals who procrastinate because of the reasons presented in the FGAP-P are more at risk regarding the antecedents of procrastination than individuals who do not procrastinate because of the reasons presented in the FGAP-P. Our results also indicate that if a person procrastinates because of deficits in study-related competencies, the individual is likely to procrastinate because of personality-related variables, beliefs, and task characteristics. The presence of external factors, assessed through reasons in the context of university framework conditions or the ability to attribute one's own procrastination externally, is a protective factor. The types at risk (*strong procrastinator type* and *internalizing type*) show high procrastination, depression, impostor self-concept, impulsivity, neuroticism, rumination, low self-worth, mindfulness, self-efficacy, and conscientiousness. This is one strength of our study. To the best of our knowledge, no previous study has incorporated this amount of procrastination antecedents while identifying different procrastination types. These results provide a deeper understanding of the procrastinating doctoral candidates.

Implications

Our findings are especially useful in the supervision and consultation of PhD candidates. First, the FGAP-P can be used to easily assess reasons for academic procrastination. High scores on the scales "study-related competencies," "personality-related variables," "beliefs," and "task characteristics" indicate high expressions of procrastination antecedents. If an individual additionally has low expressions on the scale of "university framework conditions," the PhD candidate is especially at risk and should be considered for receiving some coaching or consultation. Our findings underscore the importance of considering individual differences in doctoral screening processes, enabling early identification and support for candidates at risk of academic procrastination and associated challenges. Such insights empower supervisors to cultivate a supportive and conducive academic environment, ultimately optimizing doctoral candidates' success and well-being. For example, a supervisor could make use of temporal motivation theory by offering a PhD candidate at risk (e.g., high impulsivity, low self-efficacy) support by setting hard deadlines, which helps to reduce the effects of temporal discounting (Steel, 2007). According to our findings, supervisors should adjust their supervisory style to the needs of the PhD candidate. To initiate such measures, however, supervisors require diagnostic and intervention competencies, which are often lacking. One possible solution would be the standard implementation of such screenings at the beginning of the PhD process with the assistance of psychologically trained personnel who also contact the PhD candidate on a regular basis offering assistance. An additional possibility is the development of an online resource based on our findings, providing PhD candidates with individual action recommendations in line with temporal motivation theory. These recommendations could aim to increase the expectancy (for success) component through time management or other training to enhance self-efficacy in the PhD candidate. In addition, recommendations such as hard deadlines, goal setting, and habit building can be presented to the PhD candidate to manage sensitivity to delay (Stojanovic et al., 2021). As shown above, having high expressions on the scales of the FGAP-P is connected to several challenges. Knowing this, interventions can now be specifically designed to target those challenges. More precisely, interventions should be aimed at reducing depressive symptoms, impulsivity, rumination, and skills to defuse from a dysfunctional view of self, which is manifested in a strong impostor-self-concept or low self-worth. While there are many intervention studies in reducing procrastination (for an overview, see Zacks & Hen, 2018), none of them incorporate the totality of these antecedents, especially not the dysfunctional view of self.

Limitations and Future Research

The types found were generated using the FGAP-P, which assesses reasons for academic procrastination in PhD students. It is essential to highlight that there is skepticism about how effectively individuals can accurately gage reasons for their own dysfunctional behavior due to self-serving bias (Miller & Ross, 1975), social desirability (Nederhof, 1985), and hindsight bias (Hawkins & Hastie, 1990).

For example, individuals who belong to the *internalizing type* might be significantly higher in social desirability and, therefore, might attribute one's own procrastination to a lesser intent to external factors as they might perceive an external attribution as an excuse and, therefore, not socially desirable. What argues against it is that it has been shown that the response behavior on a procrastination questionnaire correlates highly with actual procrastination behavior (Steel et al., 2018). Additionally, we collected only cross-sectional data. Cross-sectional data does not help to understand cause-effect relationships and lacks the ability to detect intra- or interpersonal dynamics over time, in this case, the stability of identified types over time.

Another limitation of our study is our sample. All the doctoral candidates were German-speaking and enrolled in German universities; therefore, our results cannot be generalized for all doctoral candidates. The higher education system in Germany differs from most international universities because studying and PhD programs are mostly free of charge. In addition, doctoral candidates are most often employed at universities, similar to other European countries, as depicted in the theoretical background. Therefore, a German sample might not be representative of an international view on the situation of PhD candidates, especially when compared to PhD students from the United States or Canada. In addition, cultural differences were not accounted for in our sample. As shown in previous cross-cultural studies, students from East Asia show a higher degree of procrastination and lower self-efficacy than students from the United States (Klassen et al., 2009; Mann et al., 1998). Finally, differences in the job situation were not considered in our analysis. Some of the doctoral candidates have a part- or full-time job at the university, while others have no job at the university and might be forced to work to earn a living. These individual differences could lead to additional stress and indirectly influence our results.

Future research could target these limitations. First, longitudinal research designs could test the stability of identified types. One possibility would be to evaluate the reasons for and antecedents of procrastination from the start until the end of the process of doctoral candidates. This could help gain a clearer insight into whether identified types and membership types are stable over time. Another approach would be to use experience sampling to collect real-time data, reduce recall/hindsight bias, and capture fluctuations and patterns over time (Csikszentmihalyi & Larson, 1987; van Berkel et al., 2017). Moreover, it would be interesting to research whether type membership is associated with a higher likelihood of dropping out of a doctoral program in a longitudinal research design. Furthermore, a cross-cultural study identifying similarities and differences in procrastination types should be conducted. Steel (2007) mentions in his meta-analysis that 88% of the procrastination studies are conducted with a sample of US students and, therefore, lack representativeness. Previously, the FGAP-P (Gross & Hansen, 2023) needed to be translated into and validated for other languages to be used in cross-cultural studies. Finally, we suggest developing and testing the effectiveness of interventions to reduce procrastination and its antecedents. It would be of interest to research whether interventions could only reduce procrastination or also lead to a change in the reasons for procrastination and, subsequently, type membership.

Conclusion

This study helps to understand procrastination behavior among PhD candidates, which is especially important due to the lack of research on procrastination among PhD candidates. By identifying distinct procrastination types and antecedents, supervisors and support personnel can better assist PhD candidates in managing procrastination tendencies. In line with prior research done with undergraduate students, high procrastinating PhD candidates seem to be affected by the same antecedents, except that emotion suppression and cognitive reappraisal have no impact on procrastination in PhD candidates. Overall, addressing procrastination among PhD candidates closes a research gap and is crucial for creating a supportive academic environment conducive to their academic and personal growth.

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APPENDIX

Table A1. Differences between the classes regarding antecedents of procrastination

Variable	1 MPT	2 IT	3 PT	4 ET	5 SPT	6 IT	MANOVA			
	M (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*F*	*p*	η	Post-hoc
Procrastination [b]	3.15 (.58)	2.61 (.53)	1.81 (.40)	2.27 (.65)	3.84 (.43)	3.51 (.56)	**106.02**	**<.001**	**.573**	1 > 2, 3, 4; 1 < 5, 6; 2 > 3, 4; 2 < 5, 6; 3 < 4, 5, 6; 4 < 5, 6
Depression [b]	3,45 (1.10)	3.05 (.89)	2.50 (.84)	2.98 (.92)	3.40 (.81)	3.88 (.98)	**14.91**	**<.001**	**.159**	1 > 2, 3, 4; 2 > 3; 2 < 6; 3 < 4, 5, 6; 4 < 6
Imposter-Self-Concept [a]	2.40 (.75)	2.19 (.67)	1.87 (.69)	2.06 (.62)	2.61 (.67)	2.56 (.81)	**9.22**	**<.001**	**.105**	1 > 3; 2 > 3; 3, 4 < 5, 6
Self-Worth [b]	2.96 (.57)	3.08 (.54)	3.33 (.48)	3.18 (.49)	2.80 (.50)	2.92 (.77)	**6.56**	**<.001**	**.077**	1, 2 < 3; 3 > 5, 6; 4 > 5
Mindfulness [a]	3.13 (.80)	2.94 (.70)	2.63 (.74)	3.06 (0.81)	3.19 (.79)	3.34 (.93)	**6.09**	**<.001**	**.072**	1 > 3; 3 < 4, 5, 6
Self-Efficacy [a]	3.85 (.65)	3.94 (.67)	4.12 (.49)	4.13 (.65)	3.81 (.67)	3.68 (.73)	**4.14**	**.001**	**.050**	1, 2 < 3; 3 > 5, 6
Impulsivity [b]	2.50 (.58)	2.48 (.54)	2.32 (.49)	2.58 (.54)	2.93 (.74)	2.83 (.75)	**6.71**	**<.001**	**.078**	3 < 5, 6
Conscientiousness [a]	3.56 (.63)	3.80 (.57)	4.29 (.51)	4.15 (.61)	3.04 (.54)	3.01 (.78)	**37.91**	**<.001**	**.324**	1, 2 < 3, 4; 1, 2, 3, 4 > 5, 6
Neuroticism [a]	3.46 (.92)	3.30 (.82)	2.99 (.87)	3.43 (.83)	3.54 (.90)	3.67 (.87)	**4.50**	**<.001**	**.054**	1 > 3; 3 < 6

Variable	1 MPT	2 IT	3 PT	4 ET	5 SPT	6 IT	MANOVA			
	M (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*F*	*p*	η	Post-hoc
Emotion-Regulation (suppression) [a]	3.59 (1.31)	3.40 (1.26)	3.56 (1.20)	3.37 (1.35)	3.23 (1.46)	3.42 (1.52)	0.57	.726	.007	-
Emotion-Regulation (reappraisal) [a]	4.42 (1.12)	4.28 (1.08)	4.10 (1.12)	4.51 (1.19)	3.90 (1.27)	4.21 (1.19)	1.79	.113	.022	-
Symp. Rumination [b]	2.19 (.65)	1.92 (.60)	1.59 (.42)	1.85 (.57)	2.68 (.66)	2.48 (.62)	**22.60**	**<.001**	**.222**	1 > 2, 3, 4; 1 < 5; 2 > 3; 2, 3, 4 < 5, 6
Self. Rumination [b]	2.13 (.69)	2.11 (.64)	1.85 (.55)	2.08 (.64)	1.88 (.50)	2.31 (.75)	**3.74**	**.003**	**.045**	1 > 3; 3 < 6
Distraction Rumination [a]	2.23 (.59)	2.37 (.49)	2.34 (.52)	2.40 (.47)	2.18 (.45)	2.20 (.56)	1.73	.126	.021	-

Note. Significant results are bold. MPT = Moderate Procrastinator Type; IT = Insecure Type; PT = Productive Type; ET = Externalizing Type; SPT = Strong Procrastinator Type; IT = Internalizing Type; Symp. = symptom-oriented; self. = self-oriented.

[a] This variable satisfies the assumption of homoscedasticity, therefore Tuckey-HSD tests were used for post-hoc comparisons.

[b] This variable violates the assumption of homoscedasticity, therefore Games-Howell tests were used for post-hoc comparisons.

[c] Bonferroni correction was applied for MANOVA analysis to adjust for multiple comparisons.

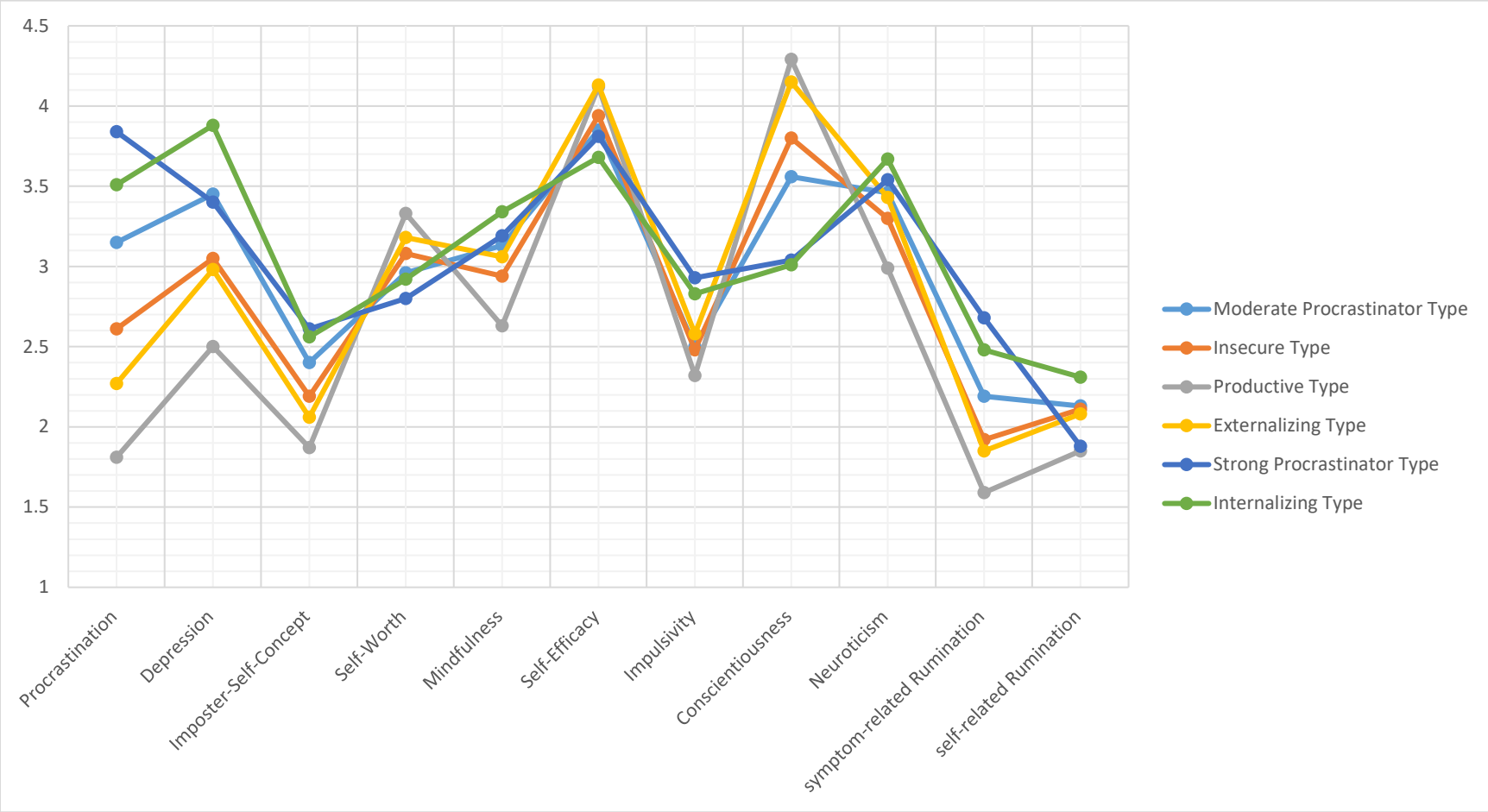

Figure A1. Differences in procrastination antecedents among the procrastination types

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