



Social factors of procrastination: group work can reduce procrastination among students

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Abstract

Research on procrastination covers a variety of individual factors (e.g., conscientiousness) and this focus is reflected in interventions against procrastination. Less emphasis is put on situational and social factors that may help students reduce procrastination, such as social interdependence. Therefore, this study investigates the relationship between interdependence with academic procrastination and affective variables. Two vignette studies with student samples ($N_1 = 320$, $N_2 = 193$) were conducted and data was analyzed with regression analyses and analyses of covariance. Results of both studies show lower state procrastination in group work with interdependence compared to individual work, especially in participants with high trait procrastination. This difference is more pronounced when interdependence is accompanied by an active commitment to finish the task on time. Further, interdependent group work is related to increased positive affect and decreased negative affect. The results demonstrate the relevance of situational and social factors for academic procrastination, and point toward new approaches for intervention.

Keywords Academic procrastination · Social factors · Group work · Interdependence · Commitment

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1 Introduction

Do you remember a situation when you needed to start an important, yet unbearably boring task? Chances are you may have procrastinated, putting off the task again and again. Now imagine the same task as part of a group assignment in which your partners depend on your contribution to do their part of the work. Could this situation have changed the way you approached the task? This question—can interdependence in group work help students procrastinate less—is the focus of the present paper. Research on antecedents of procrastination and academic procrastination alike has mostly focused on individual factors (e.g., conscientiousness, self-control, or impulsiveness). By investigating how a situational and social variable, namely interdependence, influences procrastination, this research takes a different view. The results may not only inspire programs for the reduction or even prevention of (academic) procrastination, but may also fill the research gap concerning social aspects of procrastination (cf. Klingsieck, 2013).

Academic procrastination, the voluntary delay of an intended course of study-related action despite expecting to be worse off for the delay (Steel & Klingsieck, 2016), is a common self-regulation failure (Pychyl & Flett, 2012; Steel, 2007) that seems quite prevalent among students (e.g., Day et al., 2000; Solomon & Rothblum, 1984). It may be for this reason that the grand majority of inquiries into procrastination addresses academic procrastination (however, there are exceptions, cf. Nguyen et al., 2013; van Eerde, 2016). Typical consequences of academic procrastination are not only lower academic achievement (Gareau et al., 2018; Kim & Seo, 2015; Morris & Fritz, 2015), but also lower psychological well-being (Çelik & Odaci, 2020; Krause & Freund, 2014), such as increased anxiety and distress (Argiropoulou & Patra, 2020; Sirois & Tosti, 2012; Tice & Baumeister, 1997).

Investigations into the antecedents and correlates of academic procrastination have mostly focused on variables within the individual and have thus identified a number of corresponding variables, such as personality traits and motivational aspects (cf. Klingsieck, 2013; Steel, 2007; Steel & Klingsieck, 2016). This has shaped the notion of academic procrastination as being predominantly rooted in the individual. Similarly, most interventions focus on changing factors within the individual (e.g., time-management skills, identifying and correcting dysfunctional thoughts; cf. van Eerde & Klingsieck, 2018). Only few interventions address aspects regarding the situation (e.g., stimulus control to avoid distraction) and the social environment (e.g., support from peers), let alone group dynamics that may result from interdependence. However, in line with the widely accepted notion of behavior resulting from the interaction of personal and situational factors (e.g., Blum et al., 2018; Fleeson & Nofhle, 2008; Furr & Funder, 2021), situational and social aspects should receive more attention with regard to explaining and changing procrastination (cf. Klingsieck, 2013).

Taking a closer look at social factors of academic procrastination seems all the more important, as learning and studying in higher education typically takes place in some form of social system and is oftentimes organized in groups of

students. Accordingly, recommendations for collaborative and cooperative learning abound (e.g., Barkley et al., 2014). Many of these emphasize the importance of interdependence between group members, which can be understood as a situation where “individuals share common goals and each individual’s outcomes are affected by the actions of the others” (Johnson & Johnson, 2015; p. 857). Establishing interdependence only seems reasonable, since interdependence has been related to higher performance and satisfaction, as shown in higher education (e.g., Johnson & Johnson, 2002; Shaw et al., 2000) and in other domains (e.g., Van der Vegt et al., 2001; Weber & Hertel, 2007). This raises the question whether students who tend to procrastinate when working on their own may benefit from group work with a high level of interdependence. This question was to be answered by the studies presented in this contribution. In these studies, we compared academic procrastination when working on a group task with a high level of interdependence with academic procrastination when working individually on the same task. The comparison was realized by using two vignette studies, with study 1 employing a between-subjects design and study 2 seeking to replicate the findings of study 1 using a within-subjects design. The within-subjects design should also allow for detecting intra-individual effects of interdependence on academic procrastination. Additionally, study 2 looks into whether an active commitment to other group members can further reduce procrastination and in how far interdependent group work also influences positive and negative affect as compared to individual work. Implications are discussed regarding the design of intervention and prevention measures, our theoretical understanding of procrastination, as well as consequences for research.

1.1 Personal and situational antecedents of academic procrastination

Commonly, procrastination is understood as a self-regulation failure (Pychyl & Flett, 2012; Steel, 2007). As such, procrastination and academic procrastination alike have been associated with a variety of variables within the individual (for a comprehensive overview see Klingsieck, 2013; Steel, 2007). Among the most prominent ones are lower conscientiousness (Steel & Klingsieck, 2016), higher impulsiveness (Gustavson et al., 2014; Rebetz et al., 2018; Steel, 2007), lower self-control (Przepiorka et al., 2019; Steel, 2007), lack of cognitive and meta-cognitive learning strategies (Howell & Watson, 2007), and lower self-efficacy (Steel, 2007; Van Eerde, 2003; Wäschle et al., 2014).

While there is a rich body of research on antecedents and correlates with regard to personal factors, situational factors of academic procrastination are by far less studied (cf. Klingsieck, 2013). These studies show that certain task characteristics may increase procrastination, such as general task aversiveness (Solomon & Rothblum, 1984; Steel, 2007), and perceived task tediousness or task difficulty (Senécal et al., 1997). Also, missing or ambiguous task information (Hoppe et al., 2018) and a controlling teaching style (as opposed to an autonomy-supportive one; Codina et al., 2018) have been shown to increase procrastination, whereas deadlines, if not too lenient, seem to reduce procrastination,

especially when imposed by others (Milgram et al., 2001). Evidence further suggests a link between procrastination and certain situational characteristics, such as classroom climate (Corkin et al., 2014), lecturers' teaching skills (Grunschel et al., 2013; Patrzek et al., 2012; Schraw et al., 2007), or the degree of external structure of the study program (Nordby et al., 2017).

The strong focus on individual factors conveys the common understanding of procrastination as being a phenomenon rooted mainly in the individual. Consequently, procrastination is understood by many researchers as a relatively stable disposition for unnecessary delay, some even arguing it can be completely described by the personality facet of self-control (or lack thereof; Steel, 2007). Consistent with this view, most scales have operationalized procrastination as a stable trait (e.g., the General Procrastination Scale; Lay, 1986). However, it is also possible to conceptualize procrastination as a state or episode occurring within a given time span or situation (e.g.; Hoppe et al., 2018; Krause & Freund, 2014). State procrastination can be measured, for example, with the Academic Procrastination State Inventory (APSI; Schouwenburg, 1995) or the Ecological Momentary Assessment of Procrastination Scale (e-MAPS; Wieland et al., 2018). Similar to other state/trait constructs, it only seems plausible that individuals high in trait procrastination experience more episodes of state procrastination than do those low in trait procrastination. Schouwenburg (1995) reported a strong, yet far-from-perfect correlation between measures of trait and state procrastination, indicating the potential influence of situational and/or intraindividual factors on state procrastination. Thus, individuals, whether high in trait procrastination or low, may be influenced by situational circumstances to show state procrastination to a higher or lower extent.

In accordance with the focus on individual antecedents, many interventions to reduce (academic) procrastination aim at changes within the individual (e.g., with regard to improving planning, time management, regulation of emotions or changing dysfunctional cognitions; van Eerde & Klingsieck, 2018). Only few approaches include situational (e.g., stimulus control) and social aspects (e.g., support in study groups). In general, meta-analytic findings are promising in that they demonstrate the general possibility of changing procrastination for the better (cf. Rozental et al., 2018; van Eerde & Klingsieck, 2018). At the same time, heterogeneous effects of interventions may be seen as an encouragement to further advance interventions to become more effective. This may also imply to put a stronger focus on situational and social aspects that may help reduce procrastination.

Taken together, procrastination is regarded a self-regulation failure and, as such, it is oftentimes understood as a phenomenon mainly rooted within the individual. This understanding has led research to focus on antecedents and correlates at the level of the individual. Correspondingly, many inventories measure procrastination as a trait and interventions mostly aim at changing individual aspects. Situational aspects have received much less attention, and this applies even more to social aspects, although evidence suggests they may also play an important role in in a procrastination episode.

1.2 Social antecedents of academic procrastination

Limited research exists tying aspects of the social world to academic procrastination. In their conceptual article, Harris and Sutton (1983) propose social norms to affect procrastination in the context of business and organizations. In higher education, norms have been shown to decrease academic procrastination, if they suggest starting promptly (Ackerman & Gross, 2016). Further, stereotype-threat has been related to higher procrastination in women (Deemer et al., 2014). Peers appear to increase procrastination when distracting from academic tasks (Chen et al., 2016; Nordby et al., 2017; Sénécal et al., 2003; Sirois & Giguère, 2018), although hints from qualitative studies also indicate that procrastination can be increased by a lack of social networks (Patzek et al., 2012) or lack of peer support (Schraw et al., 2007). Qualitative research also points towards the potential relevance of significant others' attitudes towards procrastination (Klingsieck et al., 2013). These findings show that social aspects seem of relevance for academic procrastination; however, the potential of social interdependence, as found in settings of group work, for reducing academic procrastination, has not been considered.

1.3 Interdependence in group work

Social interdependence can be defined as a situation where “individuals share common goals and each individual's outcomes are affected by the actions of the others” (Johnson & Johnson, 2015; p. 857). As of yet, a potentially beneficial effect of interdependent group work on procrastination has been put forward by theoretically-driven notions (Heath & Anderson, 2010; Paden & Stell, 1997) and results of one qualitative investigation (Klingsieck et al., 2013). This study suggests academic procrastination to be lower or even absent in interdependent group work because unnecessary delaying one's contribution would negatively affect other group members. So far, no hints from quantitative studies exist that could substantiate this relationship. Lending support to our assumption, theoretical and empirical accounts from different fields of psychology and beyond suggest beneficial effects of social interdependence.

Studies from the area of management and organizational psychology distinguish between different forms of interdependence. Task interdependence is usually understood as the degree to which group members depend on each other's contribution to complete a task, such as materials, information or expertise (e.g., Van der Veegt & Van de Vliert, 2001). Outcome or reward interdependence describes a situation where individual outcomes depend on other members' outcomes (Van der Veegt & Janssen, 2003; Van der Veegt & Van de Vliert, 2001).

At the group level, task interdependence has been linked to higher levels of performance and satisfaction (Campion et al., 1993, 1996) and prosocial behavior (Wageman, 1995) and these findings have been corroborated at the individual level for satisfaction (Shaw et al., 2000) and prosocial behavior (Comeau & Griffith, 2005; Ramamoorthy & Flood, 2004). Similarly, outcome or reward interdependence

has been linked to higher levels of performance and satisfaction at the group level (Campion et al., 1996) and also at the individual level (Shaw et al., 2000). However, inconsistencies in some findings (e.g., Campion et al., 1996) and empirical results (Van der Vegt & Janssen, 2003; Van der Vegt et al., 2001; Wageman, 1995) show that both, task and outcome interdependence, should be given in order to increase performance and satisfaction. Van der Vegt and Van de Vliert (2001) conclude that outcome interdependence without task interdependence can result in social loafing, while high levels of both task and outcome interdependence should result in increased performance and satisfaction among group members.

These findings are mirrored by studies from social psychology, which show how perceived indispensability of an individual contribution to a group product can enhance individual effort and performance (Weber & Hertel, 2007). For example, in group tasks with a conjunctive task structure, the group's success depends on the contribution of the least capable member (Steiner, 1972). This member then typically shows higher effort and performance as when working individually (Feltz et al., 2014; Kerr & Hertel, 2011; Thürmer et al., 2017; Weber & Hertel, 2007). As shown by Weber and Hertel (2007), this effect can partly be explained by the higher instrumentality of the individual contribution and is moderated by the visibility of members' contributions, i.e., the evaluation potential. Correspondingly, a *lack* of instrumentality may then encourage free riding (Kerr & Bruun, 1983), whereas a lack of evaluation potential may encourage social loafing (Karau & Williams, 1993).

In social psychology of education, interdependence lays at the heart of cooperative learning, which has been shown to increase, among other variables, learners' effort and achievement when compared to individual work (Johnson & Johnson, 2002; Springer et al., 1999; Stevens, 2003). Building on the work of Deutsch (1960), cooperative learning and the associated Social Interdependence Theory differentiate between means and outcome interdependence (Johnson & Johnson, 2002; Johnson et al., 2007). Means interdependence implies that in order to reach their goal members depend on each other's resources, roles, or contributions (e.g., by division of labor). Positive outcome interdependence implies that each member can only reach his/her goal if all other members reach their goals. (In contrast, negative outcome interdependence occurs when each member can only reach his/her goal if other members *do not* reach their goals). Aside from interdependence, four other components are essential, namely individual accountability, social skills, promotive interaction (i.e., mutual support), and group processing (i.e., deliberation on the learning process; Johnson & Johnson, 2002; Johnson et al., 2007). Meta-analytic findings show that learning situations with such interdependence are related to higher individual effort and achievement when compared to working individually (Johnson et al., 2007; Roseth et al., 2008; Springer et al., 1999). With regard to affective variables, meta-analyses further indicate relationships between cooperative (interdependent) learning and increased self-esteem (Johnson & Johnson, 2002; Springer et al., 1999). Therefore, the present study also investigates the effect of interdependent group work on positive and negative affect.

In summary, various accounts from different fields of psychology, sociology, and beyond indicate that interdependence between group members can positively influence individual performance and affective variables when compared to individual work. This not only raises the question whether interdependence can help reduce

procrastination, but also whether there are other variables that may even augment the effect of interdependence. One of these variables is commitment.

1.4 Commitment and interdependence

Commitment refers to the active and public confirmation to others to perform a certain behavior (Cialdini, 2009). Commitment can facilitate execution of a desired behavior as demonstrated in such different domains as volunteering (Cioffi & Garner, 1996), weight loss (Nyer & Dellande, 2010), recycling (Bryce et al., 1997), or use of sustainable transportation (Matthies et al., 2006). The facilitating effect of commitment has been explained by individuals' need for consistency (Cialdini, 2009; cf. Festinger, 1957) and by internalized and social norms to conform to one's promises (Kerr et al., 1997), and is thought to be especially strong when occurring voluntarily (Cialdini, 2009). It can be argued that commitment may also positively affect procrastination. In the present study, we assumed that commitment to other group members that promises a timely start of a given task enhances the beneficial effects of interdependence and thus further reduces procrastination. While the effect of commitment on behavior change seems quite robust, research typically does not address the relationship between commitment and affective reactions. Therefore, we sought to also shed light on the relationship between commitment and affect.

1.5 Present study and research hypotheses

The main goal of the present study was to investigate whether interdependence in group work (with and without commitment) has the potential to reduce academic procrastination as compared to individual work. Further, the study aimed to investigate whether interdependent group work results in changes in positive and negative affect. Aside from the practical relevance for intervention programs, this investigation would also contribute to the theoretical understanding of procrastination.

To this end, two vignette studies were conducted. Using a between-subjects design, study 1 compared state procrastination of an individual task with state procrastination of a group task with interdependence between group members. Study 2 replicated this comparison in a within-subjects design, thus, allowing for the investigation of intra-individual changes of procrastination. Study 2 also included a third condition where a group task with interdependence was accompanied by an active commitment to finish the task on time. Finally, study 2 compared the affective reactions toward the three conditions (individual vs. interdependence vs. interdependence with commitment). In both studies, trait procrastination was statistically controlled in order to isolate the effect of interdependence on state procrastination. Both studies served to test the first hypothesis and answer the first research question:

H1 State procrastination is lower in group work with interdependence than in individual work.

Q1 Is this relationship different for subjects with high vs. low levels of trait procrastination?

Further, study 2 served to test the following hypotheses:

H2 State procrastination is lower in group work with interdependence and an active commitment to other group members when compared to group work with interdependence and no active commitment.

H3a Positive affect is higher in group work with interdependence than in individual work.

H3b Negative affect is lower in group work with interdependence than in individual work.

Study 2 also served to answer an additional research question concerning the role of commitment with regard to affect:

Q2 How does positive and negative affect differ in group work with and without active commitment?

2 General method

2.1 Overview

We conducted two vignette studies describing a typical academic task that was described either as an individual task or as an interdependent group task. Participants were asked to rate their state procrastination with regard to the given scenario. Both studies served to test hypotheses H1 and to answer question Q1, while study 2 tested hypotheses H2, H3a and H3b and answered questions Q2.

2.2 Variables and measures

2.2.1 Interdependence

Vignettes were used to manipulate the level of interdependence of an academic task as an independent variable. In each vignette, a typical academic task was described, i.e., assembling a bibliography on a given topic. Interdependence was manipulated by describing the task either as an individual task to be performed alone or as a group task with interdependence among group members. In this latter condition, both task and outcome interdependence were realized simultaneously: Task interdependence was realized by stating that other group members could only start their part of the task once the protagonist (i.e., the participant) has finished his/her part. Outcome interdependence was realized by stating that the results would be graded on a group level. For exact vignette formulations, see Appendix.

Qualitative pretests using cognitive interviews with students of different majors showed that the vignettes were perceived as very comprehensible, realistic, and easy to imagine. Participants further indicated confidence in their ability to accurately rate their procrastination in each scenario.

2.2.2 Trait procrastination

Participants' general procrastination tendency was assessed with the German short version of Lay's (1986) General Procrastination Scale (GPS, Klingsieck & Fries, 2012; 9 Items) on a four-point rating scale ranging from *very untypical* (1) to *very typical* (4), with Cronbach's α ranging between 0.91 and 0.92 across the two studies.

In study 2, the score of trait procrastination was also used to divide the sample into a group of non-procrastinators (1st quartile of GPS) and a group of procrastinators (4th quartile of GPS). This dichotomization served to explore significant interactions between task structure and trait procrastination.

2.2.3 State procrastination

As a dependent variable, state procrastination was assessed for each vignette using a shortened version of the Academic Procrastination State Inventory (APSI, Schouwenburg, 1995; German version: Patzelt & Opitz, 2014). The APSI asks participants to think of a given time frame, and then rate the occurrence of a number of thoughts and actions that reflect a procrastination episode (e.g., "I did so many other things that there was insufficient time left for studying"; five-point scale ranging from *never* (1) to *constantly* (5)). This scale seemed suitable for the present study because the items can also be rated with a vignette scenario in mind. For the purpose of both studies, the first dimension of the APSI was shortened from 12 items to four items using iterative principal component analysis with three independent student samples. Confirmatory factor analyses with two independent student samples revealed satisfactory model fit and internal consistency (for items and results, see ESM). In its used form, core characteristics of procrastination were operationalized by only four items. The wording of the four items was adapted to account for the specific task in question, with Cronbach's α between 0.75 and 0.88 across the two studies.

2.3 Participants

Data for both studies were collected from students within regular lectures at two German public universities using paper-pencil surveys. Participation was voluntary, and anonymity of the data was assured. Participants were assured that they could end their participation at any time. There was no classroom pressure to participate. All participants were blind to the purpose of the study, and gave their informed consent before filling out the material. Ethical approval (e.g., from an ethics committee) was not necessary.

2.4 Procedure

Participants first answered items on trait procrastination, after which they were instructed to carefully read the vignettes and try to immerse themselves into the scenarios. Participants then rated their typical state procrastination regarding the task described in the vignette. They were instructed to do so as accurately and as honestly as possible.

To assess the quality of the ratings on state procrastination, two additional items measured ease of immersion into the scenarios (“How well could you immerse yourself into the scenario?”; five-point scale ranging from *very bad* (1) to *very good* (5)), and accurateness of the rating of state procrastination (“Given a real scenario, how likely is it that you would act according to your ratings in the item block above?”; five-point scale ranging from *very unlikely* (1) to *very likely* (5)). Participants were excluded from analysis if their rating on any of the two items was below three. A third item asked participants to state whether they had imagined themselves working with two males, two females, or one male and one female.

2.5 Statistical analyses

Study 1 used a between-subjects design to vary interdependence in two steps as an independent variable with state procrastination as dependent variable. To test hypothesis H1, ordinary least squares regression was calculated with interdependence as a predictor and state procrastination as criterion, while controlling for trait procrastination, gender, and age. To answer research question Q1, the interaction between interdependence and trait procrastination was included into the regression analysis in a second step.

Study 2 used a within-subjects design to vary interdependence in three steps as an independent variable. State procrastination and positive and negative affect served as dependent variables. To account for the repeated measurements while controlling for the continuous variable of trait procrastination, three Mixed Analysis of Covariance (ANCOVAs) were calculated to test hypotheses H2, H3a and H3b, respectively. All significant interactions between interdependence and trait procrastination were further analyzed using contrasts to compare levels of interdependence for non-procrastinators (i.e., 1st quartile of GPS) and procrastinators (i.e., 4th quartile of GPS).

3 Study 1

Study 1 used a between-subjects design to test hypothesis H1 postulating that state procrastination is lower in interdependent group work, as compared to individual work; and to answer research question Q1 asking whether this relationship is moderated by trait procrastination.

3.1 Method

3.1.1 Participants

A total of 353 students participated in study 1, of which 320 remained after applying inclusion criteria (260 females, $M_{age} = 23.00$, $SD_{age} = 2.79$). Most were enrolled in Bachelor programs to become special education teachers ($n = 238$), or regular teachers ($n = 78$). Participants had been enrolled in their programs for a mean duration of $M = 4.80$ semesters ($SD = 1.73$). Post-hoc analysis showed that this study was powered to have a 99% chance of detecting a small to medium main effect ($f^2 = 0.08$).

3.1.2 Interdependence

There were two levels of interdependence, with the vignette describing the task either as a non-interdependent individual task or as an interdependent task with interdependence among group members.

3.1.3 Design and data analysis

A between-subjects design was used with the task as a predictor with two levels (non-interdependence vs. interdependence), trait procrastination as a continuous predictor, and an interaction term of interdependence and trait procrastination. Participants were randomly assigned to one of the two conditions. Ordinary least squares regression analyses were used with state procrastination as criterion while controlling for other variables. For all analyses, the predictor trait procrastination was mean centered to correct for multicollinearity.

3.2 Results and short discussion

3.2.1 Descriptive statistics

Table 1 shows means and standard deviations of all variables. Results of the quality variables indicate that participants found it easy to imagine themselves experiencing the scenarios and judged the accurateness of their ratings as high. Of the 161 participants in the condition of interdependence, 89 participants reported that they had

Table 1 Descriptive statistics for quality variables, trait procrastination, and state procrastination

	Scale	<i>M</i>	<i>SD</i>
<i>Quality variables</i>			
Ease of immersion	1 – 5	4.20	0.60
Accurateness of rating	1 – 5	4.30	0.55
Trait procrastination (GPS)	1 – 4	2.71	0.63
State procrastination (APSI)	1 – 5	2.27	0.83

N = 320, *GPS* General Procrastination Scale; *APSI* Academic Procrastination State Inventory

imagined working with two females, 7 with two males, 28 with one female and one male, and 37 gave no indication.

3.2.2 State procrastination

Calculation of the zero order correlation between trait procrastination and state procrastination resulted in $r=0.51$ ($p<0.001$), indicating a strong but far from perfect relationship between both variables ($r>0.2$ small effect; $r>0.3$ medium-sized effect; $r>0.5$ large effect; Cohen, 1988). Results of the two regression models are shown in Table 2. In Model 1, state procrastination was regressed on interdependence while controlling for trait procrastination, gender, and age. Trait procrastination significantly and positively predicted state procrastination. Further and more importantly, interdependence significantly and negatively predicted state procrastination. The β coefficient resembled a medium-sized effect of interdependence ($r=0.39$; Cohen, 1988; Peterson & Brown, 2005). In Model 2, the interaction between interdependence and trait procrastination was added as a predictor. As can be seen from Table 2, the interaction coefficient was significant and negative. The β coefficient resembled a small effect size of the interaction ($r=0.26$; Cohen, 1988; Peterson & Brown, 2005). In Model 2, the included predictors accounted for an overall explanation of variance of $R^2=0.41$.

3.2.3 Short discussion

Results show that participants rated their state procrastination significantly lower when the task involved interdependence, as compared to the non-interdependence condition (supporting H1). This relationship was more pronounced for participants with high trait procrastination, thus giving a first answer for research question Q1.

Table 2 Hierarchical regression of interdependence and trait procrastination on state procrastination

	Model 1 β	Model 2 β
Age	0.02	0.02
Female	-0.08	-0.08
Trait Procrastination ^a	0.54***	0.69***
Interdependence	-0.34***	-0.34***
Interdependence \times Trait Procrastination		-0.21**
R^2	0.39	0.41
F	49.3***	43.4***
ΔR^2		0.02**
ΔF		12.3**

$N=320$

^aTrait Procrastination (GPS) mean centered for all regression analyses

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

This provides a first quantitative hint towards the beneficial effect of interdependence with regard to reducing procrastination among students.

No differences in ratings were found across gender and age of participants. This is in line with a meta-analysis that could not substantiate correlations of procrastination with age and gender (Steel, 2007), although more recent studies suggest procrastination to be lower among younger individuals and females (Beutel et al., 2016; Steel & Ferrari, 2013). The strong relationship between trait procrastination and state procrastination supports the general plausibility of the findings.

Although participants were randomly assigned to vignette conditions, unobserved heterogeneity cannot be completely ruled out. Also, the between-subjects design is not suitable to investigate intra-individual variation in state procrastination. For these reasons, and to replicate findings of the first study, study 2 used a within-subjects design.

4 Study 2

Study 2 served to replicate the findings of study 1 in a within-subjects design, and to further test hypotheses H2, stating that commitment would lead to an additional decrease of state procrastination in interdependent group work. Also, to test hypotheses H3a and H3b and to answer research question Q2, affective reaction was compared between the conditions of non-interdependence, interdependence and interdependence with commitment.

4.1 Method

4.1.1 Participants

A new sample of 223 students took part in the survey, of which 193 remained after applying inclusion criteria (139 female, $M_{age}=21.5$, $SD_{age}=1.96$). Most participants were enrolled in Bachelor programs ($n=176$) or Master programs ($n=12$) to become regular teachers ($n=151$) or special education teachers ($n=30$). Participants had been enrolled in their programs for a mean duration of 4.2 semesters ($SD=1.71$). Post-hoc analysis showed that this study was powered to have a 95% chance of detecting a small main effect ($\eta_p^2 = 0.02$, based on a correlation of 0.5 between repeated measures).

4.1.2 Interdependence

The same vignettes as in study 1 were used. Interdependence was varied in three levels by describing the task either as (1) a non-interdependent individual task, (2) an interdependent group task, or (3) an interdependent group task with commitment. This last condition was identical to the interdependent condition, but added one sentence describing a commitment to the group members to finish the task on time (for

vignette formulation, see Appendix). Participants received and rated all three scenarios sequentially and order of presentation was balanced across participants.

4.1.3 Affective reaction

As a second dependent variable, positive and negative affect was measured using the two subscales of the Positive and Negative Affect Schedule (PANAS, Watson et al., 1988) in its German version (Krohne et al., 1996). The PANAS presents 20 adjectives to measure positive affect (e.g., “happy”) and negative affect (e.g., “afraid”) on a five-point scale ranging from *not at all* (1) to *very much* (5). Cronbach’s α of the two subscales ranged between 0.83 and 0.89 across the three repeated measurements.

4.1.4 Design and data analysis

A mixed factorial 3 (interdependence: non-interdependence vs. interdependence vs. interdependence with commitment) \times 6 (order of presentation) design with trait procrastination as a continuous covariate was used. The first factor was a within-subjects variable, whereas the second factor was a between-subjects variable to control for sequence effects. Mixed Analyses of Covariance (ANCOVAs) were used to analyze the data, and Greenhouse–Geisser adjustment was used to correct for violations of sphericity. For all significant interactions between interdependence and trait procrastination, contrasts with Bonferroni-corrected p -values were calculated to compare levels of interdependence for both non-procrastinators (i.e., 1st quartile of GPS) and procrastinators (i.e., 4th quartile of GPS).

4.2 Results and short discussion

4.2.1 Descriptive statistics

Means and standard deviations of all variables are shown in Table 3. In the condition of interdependence (with commitment), 90 (86) participants reported that they had imagined working with two females, 23 (20) with two males, 41 (44) with one female and one male, and 39 (43) gave no indication.

4.2.2 State procrastination

An ANCOVA with state procrastination as a dependent variable revealed significant main effects of interdependence, $F(1.65, 298.51) = 13.83$, $MSE = 4.21$, $p < 0.001$, $\eta_p^2 = 0.07$, and trait procrastination, $F(1, 181) = 121.14$, $MSE = 79.29$, $p < 0.001$, $\eta_p^2 = 0.40$, and a significant interaction between interdependence and trait procrastination, $F(1.65, 298.51) = 52.46$, $MSE = 15.98$, $p < 0.001$, $\eta_p^2 = 0.225$.

For non-procrastinators (1st quartile in GPS; $N = 48$), contrasts with Bonferroni-correction revealed significant differences between non-interdependence and interdependence, $F(1, 42) = 21.66$, $MSE = 3.80$, $p < 0.001$, $\eta_p^2 = 0.34$, and between non-interdependence and interdependence with commitment, $F(1, 42) = 27.62$,

Table 3 Descriptive statistics of all main variables of study 2

	Scale	<i>M</i>	<i>SD</i>
Age		21.5	1.96
Ease of immersion	1–5	4.19	0.55
<i>Accuratness of rating</i>	1–5		
a. No interdependence		4.40	0.55
b. Interdependence		4.43	0.55
c. Interdependence with commitment		4.52	0.51
Trait procrastination (GPS)	1–4	2.60	0.64
<i>State procrastination (APSI)</i>	1–5		
a. No interdependence		2.57	0.96
b. Interdependence		1.84	0.73
c. Interdependence with commitment		1.56	0.56
<i>Positive affect (PANAS)</i>	1–5		
a. No interdependence		2.39	0.73
b. Interdependence		2.64	0.70
c. Interdependence with commitment		2.78	0.71
<i>Negative affect (PANAS)</i>	1–5		
a. No interdependence		1.76	0.61
b. Interdependence		1.70	0.64
c. Interdependence with commitment		1.72	0.62

N = 193. *GPS* General Procrastination Scale; *APSI* Academic Procrastination State Inventory, *PANAS* Positive and Negative Affect Schedule

Table 4 Descriptive statistics of state procrastination, positive and negative affect for non-procrastinators (1st quartile of GPS), and procrastinators (4th quartile of GPS) in study 2

	Non-procrastinators (1st quartile of GPS) <i>M</i> (<i>SD</i>)	Procrastinators (4th quartile of GPS) <i>M</i> (<i>SD</i>)
<i>State procrastination</i>		
No interdependence	1.70 (0.48)	3.41 (0.92)
Interdependence	1.43 (0.43)	2.26 (0.91)
Interdependence with commitment	1.36 (0.41)	1.82 (0.73)
<i>Positive affect</i>		
No interdependence	2.85 (0.74)	2.05 (0.63)
Interdependence	2.97 (0.58)	2.36 (0.66)
Interdependence with commitment	2.99 (0.65)	2.52 (0.73)
<i>Negative affect</i>		
No interdependence	1.54 (0.54)	1.87 (0.64)
Interdependence	1.73 (0.70)	1.77 (0.70)
Interdependence with commitment	1.62 (0.55)	1.89 (0.68)

$N_{Q1} = N_{Q4} = 48$; *GPS* General Procrastination Scale

$MSE=5.90$, $p<0.001$, $\eta_p^2 = 0.40$. Following Cohen's convention ($\eta_p^2 > 0.04$ small effect; $\eta_p^2 > 0.09$ medium-sized effect; $\eta_p^2 > 0.25$ large effect; Cohen, 1988), the effects can be considered quite large. As can be seen from Table 4, in the group of non-procrastinators, mean state procrastination was higher in non-interdependent individual work as compared to interdependent group work both with and without commitment.

For procrastinators (4th quartile in GPS; $N=48$), contrasts with Bonferroni-correction revealed significant differences between non-interdependence and interdependence, $F(1, 42)=65.43$, $MSE=63.23$, $p<0.001$, $\eta_p^2 = 0.61$, between non-interdependence and interdependence with commitment, $F(1, 42)=85.86$, $MSE=112.31$, $p<0.001$, $\eta_p^2 = 0.67$, and between interdependence and interdependence with commitment, $F(1, 42)=14.62$, $MSE=7.0$, $p<0.01$, $\eta_p^2 = 0.26$. With large effect sizes exceeding those in the group of non-procrastinators, mean state procrastination was highest in non-interdependent individual work, lower in interdependent group work, and lowest in interdependent group work with commitment (Table 4).

These results replicate the findings from Study 1 regarding H1 and research question Q1. As in study 1, state procrastination was lower in the condition of interdependence, and this effect was stronger for high trait procrastinators. In addition, commitment lead to a further decrease of state procrastination in the group of procrastinators, thus supporting hypothesis H2 in this group.

4.2.3 Positive affect

An ANCOVA with positive affect as a dependent variable revealed a significant main effect of trait procrastination, $F(1, 177)=33.25$, $MSE=34.93$, $p<0.001$, $\eta_p^2 = 0.16$, and a significant interaction between trait procrastination and interdependence $F(1.65, 291.89)=9.14$, $MSE=1.56$, $p<0.001$, $\eta_p^2 = 0.05$. Further, there was a significant triple interaction between trait procrastination, interdependence and order of presentation, $F(8.25, 291.89)=2.18$, $MSE=0.37$, $p=0.028$, $\eta_p^2 = 0.06$.

To explore the triple interaction, separate one-way ANOVAs were calculated for each of the six levels of order of presentation, with trait procrastination as a metric covariate, and Bonferroni-corrected p -values. Results showed no significant effects, probably due to low statistical power. However, on a descriptive level, in all levels of order of presentation, scores of positive affect were lower for non-interdependent individual work compared to both conditions of interdependent work.

Exploring the interaction between interdependence and trait procrastination, contrasts with Bonferroni-corrected p -values revealed no significant differences between levels of interdependence in the group of non-procrastinators. For procrastinators, contrasts revealed significant differences between non-interdependence and interdependence, $F(1, 42)=17.21$, $MSE=5.23$, $p<0.001$, $\eta_p^2 = 0.29$, and between non-interdependence and interdependence with commitment, $F(1, 42)=21.86$, $MSE=11.84$, $p<0.001$, $\eta_p^2 = 0.34$. These large effects (Cohen, 1988) indicate that interdependent group work (with and without commitment) was associated with higher ratings on positive affect, but only for procrastinators, thus supporting hypothesis H3a for this group. The results also give a first answer to research question Q2a by indicating that an active

commitment to other group members is not related to higher or lower positive affect (see Table 4).

4.2.4 Negative affect

An ANCOVA with negative affect as a dependent variable revealed a significant main effect of interdependence, $F(1.64, 290.37)=5.02$, $MSE=0.68$, $p=0.011$, $\eta_p^2 = 0.03$, and a significant interaction between trait procrastination and interdependence, $F(1.64, 290.37)=6.80$, $MSE=0.93$, $p<0.01$, $\eta_p^2 = 0.04$.

For non-procrastinators, contrasts revealed no significant differences of negative affect between levels of interdependence. For procrastinators, contrasts revealed a significant difference of negative affect between non-interdependence and interdependence (without commitment), $F(1, 42)=7.86$, $MSE=1.47$, $p=0.046$, $\eta_p^2 = 0.16$, with lower negative affect in interdependent work, as shown in Table 4 (medium-sized effect; Cohen, 1988). There was no significant difference in negative affect between interdependence and interdependence with commitment. These results support hypothesis H3b, showing that interdependent group work is related to lower levels of negative affect, but only in the group of procrastinators. The results also give a first answer to research question Q2 by indicating that an active commitment to other group members is not related to higher or lower negative affect (see Table 4).

4.2.5 Short discussion

Results replicate the findings of study 1, showing that state procrastination is lower in interdependent group work compared to non-interdependent individual work. This effect also applies to participants with low levels of trait procrastination, although it was more pronounced in participants with high levels of trait procrastination. Further, the latter group also showed an additional decrease of state procrastination when interdependence was accompanied by commitment (thus supporting H2). These results add to those of study 1 by showing that interdependence can lead to intra-individual variation of state procrastination and that this effect can be enhanced by an active commitment to other group members.

Results also show that in comparison with non-interdependent individual work, interdependent group work is related to higher levels of positive affect and lower levels of negative affect, but only in the group of procrastinators (thus partly supporting hypotheses H3a and H3b). This is consistent with other research showing beneficial effects of interdependence on affective variables (cf. Section 1.3). Further, while an active commitment to other group members is related to reduced state procrastination, this relationship could not be found for positive or negative affect, thus giving a first answer to our research question Q2.

5 General discussion

5.1 Summary

This study investigated whether or not academic procrastination can be reduced by group settings in which there is interdependence among group members. In two vignette studies, ratings on state procrastination were obtained with regard to study scenarios with and without interdependence. Interdependence was manipulated such that group members rely on each other's contribution (task interdependence) and receive group rewards (outcome interdependence). Results of both studies showed that ratings on state procrastination were lower in interdependent group work than in non-interdependent individual work. This difference was more pronounced for participants with high trait procrastination. In both studies, trait procrastination was a significant moderator for the relationship between interdependence and state procrastination. This can be seen as an indicator that state procrastination was reliably measured regarding the different scenarios. These findings are in line with various accounts on the beneficial effects of interdependence on effort and performance (cf. paragraph 1.3), and extend these by also showing effects on procrastination.

In the group of high trait-procrastinators, ratings on state procrastination regarding the vignette scenarios was further reduced when interdependent group work was accompanied by an active and public commitment to finish the task on time. Similar effects have been shown with regard to behavior change in other domains, and this is typically explained by consistency theory (Cialdini, 2009; cf. Festinger, 1957) and the influence of internalized or social norms to stick to one's promise (Kerr et al., 1997). This research expands these findings by indicating that a commitment to other group members can enhance the beneficial effect of interdependent group work.

Investigating affective reactions, the vignette with interdependent group work resulted in an increase of positive affect and a decrease of negative affect, but only in the group of procrastinators. This is consistent with findings in different fields of psychology that show beneficial effects of interdependence on satisfaction and self-esteem (Johnson et al., 2007; Shaw et al., 2000; Van der Vegt et al., 2001). From the perspective of social psychology, Weber and Hertel (2007) speculated whether in interdependent tasks, indispensability of individual contributions can support self-worth (i.e., positive affect), or whether the emotional burden of not letting the group down may also increase negative affect. The current research supports the former assumption. However, more research is necessary to substantiate these findings.

Taken together, the results can be seen as a first indication of the positive effects of interdependence in group work with regard to reducing academic procrastination. It further suggests that interdependence is related to favorable affective states. This underlines the importance to take situational factors, and especially social aspects, into account, when investigating, explaining, treating and preventing academic procrastination.

5.2 Theoretical and practical implications

The results of the current study may carry important implications not only for the theoretical understanding of procrastination but also for research and for interventions and programs to reduce or prevent procrastination. Current interventions against academic procrastination mainly focus on changes within the individual (e.g., Rozentel et al., 2018; van Eerde & Klingsieck, 2018) and put less emphasis on situational or social aspects. Heterogeneous effects, however, point towards the potential to improve the impact of many interventions against procrastination. The results of the current studies suggest that social aspects, such as interdependence, offer important contributions that may be incorporated into existing interventions. Further, taking up the position that prevention is better than the cure (i.e., interventions), our results also point towards the potential to preclude academic procrastination by designing tasks to be interdependent in nature. According to the results of the current study, this would reduce state procrastination regardless of individual trait procrastination, but even more so for students high in trait procrastination.

For example, teachers could adapt individual assignments to become interdependent group tasks. Teachers may establish outcome interdependence by introducing group level rewards, in combination with task interdependence by assembling groups in a way that each member contributes unique skills or other types of necessary input; further, they may split larger assignments into smaller subtasks that need to be completed sequentially by group members (Brewer & Klein, 2006; Johnson & Johnson, 2002; Weber & Hertel, 2007). Teachers and counselling staff may also promote interdependence by advising students to form study groups and organize their learning activities in an interdependent manner. Further, students may be advised to openly formulate specific commitments regarding their intended work, to further support their work on the assignments. It should be noted, however, that not all assignments may be suited to be completed by an interdependent group, for example, when the implementation of group work is too difficult, too costly, or not compliant with rules and regulations (Johnson et al., 2007).

Our results also carry implications for the theoretical understanding of procrastination. Current studies mainly focus on antecedents and correlates of procrastination that are located at the personal level. This shapes a theoretical understanding of procrastination as a self-regulation failure mainly rooted within the individual. The current findings point towards the need to consider situational and social aspects when explaining the genesis of procrastination. This should result in a more comprehensive understanding of procrastination as a product of both personal and situational variables.

Finally, such an understanding should also carry implications for the measurement of procrastination. So far, most investigations of procrastination do not explicitly distinguish between procrastination as a trait and procrastination as a state when quantifying procrastination. The current results show that, though closely related, both constructs are not identical. For researchers investigating procrastination, the results show that it may be important to clearly and deliberately differentiate between the two.

5.3 Limitations and future research

This contribution stresses the importance of social aspects when attempting to reduce or even prevent academic procrastination. It has shown the relationship between interdependence and state procrastination; however, there is an abundance of other social aspects that have been shown to influence individual functioning in groups, such as social support (e.g., Hüffmeier et al., 2014), group cohesion (e.g., Gully et al., 2012), and group identification (e.g., Solansky, 2011), intergroup competition (e.g., Erev et al., 1993), or intragroup diversity of temporal styles (e.g., Gevers et al., 2006). Whether these and other aspects influence state procrastination remains an open question.

It should also be noted that the current study compared individual work without interdependence with group work with interdependence. By doing so it follows studies on interdependence from educational and social psychology (e.g., Johnson & Johnson, 2002; Weber & Hertel, 2007), thus drawing the comparison between individual work and group work. However, it cannot be ruled out that the mere presence of other group members had an effect on the dependent variables regardless of the aspect of interdependence (e.g., by social comparison; Seta, 1982). Future research could seek to delineate the findings of the present study.

Three additional limitations should be mentioned, namely generalizability, lack of performance measures, and level of analysis. Although ratings of state procrastination have consistently been lower in conditions of interdependent group work, at this point, it remains unclear whether these results generalize from a hypothetical vignette scenario that is imagined by participants to actual tasks in the real world. More research is necessary to investigate the effects using academic tasks in more realistic settings, for example, by using field experiments. Second, this research has focused on procrastination and not on performance. Although the relationship between academic procrastination and academic performance has been shown (Kim & Seo, 2015), future studies could also include measures of performance to further qualify the effects of group work. Finally, the approach has focused on the effect of interdependence on one individual team member. However, it is only plausible that other members of a group are affected in one way or another by a member with higher or lower trait procrastination (Ferrari & Pychyl, 2012; Legood et al., 2018; van Hooft & van Mierlo, 2018), which could be addressed in future research.

6 Conclusion

This contribution is a first hint from a quantitative study that group work with interdependence between group members can reduce state procrastination, especially for individuals with high trait procrastination and when accompanied by commitment. This finding indicates ways to reduce or even prevent procrastination by adapting academic assignments. Further, it extends the common understanding of procrastination as being a behavior that is predominantly rooted within the individual by showing social aspects that seem to affect procrastination. Future research should

replicate these results in field studies using not only self-report measures of procrastination but also performance measures.

Appendix

Vignettes for study 1 and study 2

Individual work	Group work with interdependence	Group work with interdependence and with commitment
Imagine you are taking part in an obligatory course of your program. For course credit you have to assemble a bibliography on a given topic by using a scientific data base. [The bibliography is due three days from now at 12 pm. ^a]		
You have to compile the bibliography by yourself	You have to compile the bibliography with two fellow students. Each of you has to contribute a part of the work	
The result of your work will be graded	The result of your group work will be graded. The two others can only begin their part once your part is finished	
You intend to work on the task this afternoon. You want to be finished by this evening	You intend to work on the task this afternoon. You want to be finished by this evening	You intend to work on the task this afternoon. You promised your fellow students to send them the results of your part this evening
	Your fellow students are two of your friends that are very dedicated to their studies	
The bibliography will be graded and this grade will make up 50% of your final course grade		

^aThis sentence was omitted in study 2

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Data availability All data are available upon request.

Declarations

Conflict of interest The authors declare that they have no conflict of interests.

Consent to participate All participants in the study provided informed consent.

Consent for publication All authors gave their consent for this publication.

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References

- Ackerman, D. S., & Gross, B. L. (2016). My instructor made me do it: Task characteristics of procrastination. *Journal of Marketing Education*, 27(1), 5–13. <https://doi.org/10.1177/0273475304273842>
- Argiropoulou, M., & Patra, V. (2020). The role of psychological distress as a potential route through which procrastination may confer risk for reduced life satisfaction. *Current Psychology*. <https://doi.org/10.1007/s12144-020-00739-8>
- Barkley, E. F., Major, C. H., & Cross, K. P. (2014). *Collaborative learning techniques: A handbook for college faculty*. Jossey-Bass.
- Beutel, M. E., Klein, E. M., Aufenanger, S., Brähler, E., Dreier, M., Müller, K. W., et al. (2016). Procrastination, distress and life satisfaction across the age range – a German representative community study. *PLoS ONE*, 11(2), e0148054. <https://doi.org/10.1371/journal.pone.0148054>
- Blum, G. S., Rauthmann, J. B., Göllner, R., Lischetzke, T., & Schmitt, M. (2018). The nonlinear interaction of person and situation (NIPS) model: Theory and empirical evidence. *European Journal of Personality*, 32, 286–305. <https://doi.org/10.1002/per.2138>
- Brewer, S., & Klein, J. D. (2006). Type of positive interdependence and affiliation motive in an asynchronous, collaborative learning environment. *Educational Technology Research and Development*, 54, 331–354.
- Bryce, W. J., Day, R., & Olney, T. J. (1997). Commitment approach to motivating community recycling: New Zealand curbside trial. *Journal of Consumer Affairs*, 31(1), 27–52.
- Campion, M. A., Medsker, G. J., & Higgs, A. C. (1993). Relations between work group characteristics and effectiveness: Implications for designing effective work groups. *Personnel Psychology*, 46, 823–850.
- Campion, M. A., Papper, E. M., & Medsker, G. J. (1996). Relations between work team characteristics and effectiveness: A replication and extension. *Personnel Psychology*, 49, 429–452.
- Çelik, Ç. B., & Odacı, H. (2020). Subjective well-being in university students: What are the impacts of procrastination and attachment styles? *British Journal of Guidance & Counselling*. <https://doi.org/10.1080/03069885.2020.1803211>
- Chen, B.-B., Shi, Z., & Wang, Y. (2016). Do peers matter? Resistance to peer influence as a mediator between self-esteem and procrastination among undergraduates. *Frontiers in Psychology*, 7, 1529. <https://doi.org/10.3389/fpsyg.2016.01529>
- Cialdini, R. B. (2009). *Influence: Science and practice*. Pearson Education.
- Cioffi, D., & Garner, R. (1996). On doing the decision: Effects of active versus passive choice on commitment and self-perception. *Personality & Social Psychology Bulletin*, 22(2), 133–147. <https://doi.org/10.1177/0146167296222003>
- Codina, N., Valenzuela, R., Pestana, J. V., & Gonzalez-Conde, J. (2018). Relations between student procrastination and teaching styles: Autonomy-supportive and controlling. *Frontiers in Psychology*, 9(809), 1–7. <https://doi.org/10.3389/fpsyg.2018.00809>
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Hillsdale: Lawrence Earlbaum Associates.
- Comeau, D., & Griffith, R. L. (2005). Structural interdependence, personality, and organizational citizenship behavior. An examination of person-environment interaction. *Personnel Review*. <https://doi.org/10.1108/00483480510591453>
- Corkin, D. M., Yu, S. L., Wolters, C. A., & Wiesner, M. (2014). The role of the college classroom climate on academic procrastination. *Learning and Individual Differences*, 32, 294–303. <https://doi.org/10.1016/j.lindif.2014.04.001>
- Day, V., Mensink, D., & O'Sullivan, M. (2000). Patterns of academic procrastination. *Journal of College Reading and Learning*, 30(2), 120–134. <https://doi.org/10.1080/10790195.2000.10850090>
- Deemer, E. D., Smith, J. L., Carroll, A. N., & Carpenter, J. P. (2014). Academic procrastination in STEM: Interactive effects of stereotype threat and achievement goals. *The Career Development Quarterly*, 62, 143–155. <https://doi.org/10.1002/j.2161-0045.2014.00076.x>

- Deutsch, M. (1960). The effects of motivational orientation upon trust and suspicion. *Human Relations, 13*, 123–139.
- Erev, I., Bornstein, G., & Galili, R. (1993). Constructive intergroup competition as a solution to the free rider problem: A field experiment. *Journal of Experimental Social Psychology, 29*, 463–478.
- Feltz, D. L., Forlenza, S. T., Winn, B., & Kerr, N. L. (2014). Cyber buddy Is better than no buddy: A test of the Köhler motivation effect in exergames. *Games for Health Journal, 3*(2), 98–105. <https://doi.org/10.1089/g4h.2013.0088>
- Ferrari, J. R., & Pychyl, T. A. (2012). “If I wait, my partner will do it:” The role of conscientiousness as a mediator in the relation of academic procrastination and perceived social loafing. *North American Journal of Psychology, 14*(1), 13–24.
- Festinger, L. (1957). *A theory of cognitive dissonance*. Stanford University Press.
- Fleeson, W., & Nofzle, E. (2008). The end of the person–situation debate: An emerging synthesis in the answer to the consistency question. *Social and Personality Psychology Compass, 2*(4), 1667–1684. <https://doi.org/10.1111/j.1751-9004.2008.00122.x>
- Furr, R. M., & Funder, D. (2021). Persons, situations, and person-situation interactions. In O. P. John & R. W. Robins (Eds.), *Handbook of personality: Theory and research*. Guilford.
- Gareau, A., Chamandy, M., Kljajic, K., & Gaudreau, P. (2018). The detrimental effect of academic procrastination on subsequent grades: The mediating role of coping over and above past achievement and working memory capacity. *Anxiety, Stress and Coping, 32*(2), 141–154. <https://doi.org/10.1080/10615806.2018.1543763>
- Gevers, J. M., Rutte, C. G., & van Eerde, W. (2006). Meeting deadlines in work groups: Implicit and explicit mechanisms. *Applied Psychology: An International Review, 55*(1), 52–72.
- Grunschel, C., Patzke, J., & Fries, S. (2013). Exploring reasons and consequences of academic procrastination: An interview study. *European Journal of Psychology of Education, 28*(3), 841–861. <https://doi.org/10.1007/s10212-012-0143-4>
- Gully, S. M., Devine, D. J., & Whitney, D. J. (2012). A meta-analysis of cohesion and performance. *Small Group Research, 43*(6), 702–725. <https://doi.org/10.1177/1046496412468069>
- Gustavson, D. E., Miyake, A., Hewitt, J. K., & Friedman, N. P. (2014). Genetic relations among procrastination, impulsivity, and goal-management ability: Implications for the evolutionary origin of procrastination. *Psychological Science, 25*(6), 1178–1188. <https://doi.org/10.1177/0956797614526260>
- Harris, N. N., & Sutton, R. I. (1983). Task procrastination in organizations: A framework for research. *Human Relations, 36*(11), 987–996.
- Heath, J., & Anderson, J. (2010). Procrastination and the extended will. In C. Andreou & M. D. White (Eds.), *The thief of time* (pp. 1–24). Oxford University Press.
- Hoppe, J., Preissler, I., & Förster, K. (2018). A cross-lagged panel design on the causal relationship of task ambiguity and state procrastination: A preliminary investigation. *North American Journal of Psychology, 20*, 383–396.
- Howell, A. J., & Watson, D. C. (2007). Procrastination: Associations with achievement goal orientation and learning strategies. *Personality and Individual Differences, 43*, 167–178.
- Hüffmeier, J., Wessolowski, K., van Randenborgh, A., Bothin, J., Schmid-Loertzer, N., & Hertel, G. (2014). Social support from fellow group members triggers additional effort in groups. *European Journal of Social Psychology, 44*(4), 287–296. <https://doi.org/10.1002/ejsp.2021>
- Johnson, D. W., & Johnson, R. T. (2002). Social interdependence theory and university instruction – theory into practice. *Swiss Journal of Psychology, 61*(3), 119–129.
- Johnson, D. W., & Johnson, R. T. (2015). Cooperation and Competition. In J. D. Wright (Ed.), *International encyclopedia of the social & behavioral sciences (second edition)*. Elsevier.
- Johnson, D. W., Johnson, R. T., & Smith, K. (2007). The state of cooperative learning in postsecondary and professional settings. *Educational Psychology Review, 19*, 15–29.
- Karau, S. J., & Williams, K. D. (1993). Social loafing: A meta-analytic review and theoretical integration. *Journal of Personality and Social Psychology, 65*(4), 681–706.
- Kerr, N. L., & Bruun, S. E. (1983). Dispensability of member effort and group motivation losses: Free-rider effects. *Journal of Personality and Social Psychology, 44*(1), 78–94.
- Kerr, N. L., Garst, J., Lewandowski, D. A., & Harris, S. E. (1997). That still, small voice: Commitment to cooperate as an internalized versus a social norm. *Personality & Social Psychology Bulletin, 23*(12), 1300–1311. <https://doi.org/10.1177/01461672972312007>

- Kerr, N. L., & Hertel, G. (2011). The Köhler group motivation gain: How to motivate the 'weak links' in a group. *Social and Personality Psychology Compass*, 5(1), 43–55. <https://doi.org/10.1111/j.1751-9004.2010.00333.x>
- Kim, K. R., & Seo, E. H. (2015). The relationship between procrastination and academic performance: A meta-analysis. *Personality and Individual Differences*, 82, 26–33. <https://doi.org/10.1016/j.paid.2015.02.038>
- Klingsieck, K. B., & Fries, S. (2012). Allgemeine Prokrastination: Entwicklung und Validierung einer deutschsprachigen Kurzsкала der General Procrastination Scale (Lay, 1986). [General procrastination: Development and validation of the German short scale of the General Procrastination Scale (Lay, 1986)]. *Diagnostica*, 58(4), 182–193. <https://doi.org/10.1026/0012-1924/a000060>
- Klingsieck, K. (2013). Procrastination. When good things don't come to those who wait. *European Psychologist*, 18(1), 24–34.
- Klingsieck, K. B., Grund, A., Schmid, S., & Fries, S. (2013). Why students procrastinate: A qualitative approach. *Journal of College Student Development*, 54(4), 397–412. <https://doi.org/10.1353/csd.2013.0060>
- Krause, K., & Freund, A. M. (2014). Delay or procrastination – A comparison of self-report and behavioral measures of procrastination and their impact on affective well-being. *Personality and Individual Differences*, 63, 75–80. <https://doi.org/10.1016/j.paid.2014.01.050>
- Krohne, H. W., Egloff, B., Kohlmann, C.-W., & Tausch, A. (1996). Untersuchung mit einer deutschen Version der „Positive and Negative Affect Schedule“ (PANAS) [Investigation with the German version of the „Positive and Negative Affect Schedule“ (PANAS)]. *Diagnostica*, 42(2), 139–156.
- Lay, C. H. (1986). At last, my research article on procrastination. *Journal of Research in Personality*, 20, 474–495.
- Legood, A., Lee, A., Schwarz, G., & Newman, A. (2018). From self-defeating to other defeating: Examining the effects of leader procrastination on follower work outcomes. *Journal of Occupational and Organizational Psychology*, 91(2), 430–439. <https://doi.org/10.1111/joop.12205>
- Matthies, E., Klockner, C. A., & Preissner, C. L. (2006). Applying a modified moral decision making model to change habitual car use: How can commitment be effective? *Applied Psychology*, 55(1), 91–106. <https://doi.org/10.1111/j.1464-0597.2006.00237.x>
- Milgram, N. A., Dangour, W., & Raviv, A. (2001). Situational and personal determinants of academic procrastination. *The Journal of General Psychology*, 119(2), 123–133.
- Morris, P. E., & Fritz, C. O. (2015). Conscientiousness and procrastination predict academic coursework marks rather than examination performance. *Learning and Individual Differences*, 39, 193–198. <https://doi.org/10.1016/j.lindif.2015.03.007>
- Nguyen, B., Steel, P., & Ferrari, J. R. (2013). Procrastination's impact in the workplace and the workplace's impact on procrastination. *International Journal of Selection and Assessment*, 21(4), 388–399. <https://doi.org/10.1111/ijsa.12048>
- Nordby, K., Klingsieck, K. B., & Svartdal, F. (2017). Do procrastination-friendly environments make students delay unnecessarily? *Social Psychology of Education*, 20(3), 491–512. <https://doi.org/10.1007/s11218-017-9386-x>
- Nyer, P. U., & Dellande, S. (2010). Public commitment as a motivator for weight loss. *Psychology and Marketing*, 27(1), 1–12. <https://doi.org/10.1002/mar.20316>
- Paden, N., & Stell, R. (1997). Reducing procrastination through assignment and course design. *Marketing Education Review*, 7(2), 17–25. <https://doi.org/10.1080/10528008.1997.11488587>
- Patrzek, J., Grunschel, C., & Fries, S. (2012). Academic procrastination: The perspective of university counsellors. *International Journal for the Advancement of Counselling*, 34(3), 185–201. <https://doi.org/10.1007/s10447-012-9150-z>
- Patzelt, J., & Opitz, I. (2014). *Deutsche Version des Academic Procrastination State Inventory (APSI-d)*. [German version of the Academic Procrastination State Inventory (APSI-d)]. Köln: Gesis.
- Peterson, R. A., & Brown, S. P. (2005). On the use of beta coefficients in meta-analysis. *Journal of Applied Psychology*, 90(1), 175–181. <https://doi.org/10.1037/0021-9010.90.1.175>
- Przepiórka, A., Błachnio, A., & Siu, N. (2019). The relationships between self-efficacy, self-control, chronotype, procrastination and sleep problems in young adults. *Chronobiology International*, 38(8), 1025–1035. <https://doi.org/10.1080/07420528.2019.1607370>
- Pychyl, T. A., & Flett, G. L. (2012). Procrastination and self-regulatory failure: An introduction to the special issue. *Journal of Rational-Emotive & Cognitive-Behavior Therapy*, 30(4), 203–212. <https://doi.org/10.1007/s10942-012-0149-5>

- Ramamoorthy, N., & Flood, P. C. (2004). Individualism/collectivism, perceived task interdependence and teamwork attitudes among Irish blue-collar employees: A test of the main and moderating effects. *Human Relations, 57*(3), 347–366.
- Rebetetz, M. M. L., Rochat, L., Barsics, C., & Van der Linden, M. (2018). Procrastination as a self-regulation failure: The role of impulsivity and intrusive thoughts. *Psychological Reports, 121*(1), 26–41. <https://doi.org/10.1177/0033294117720695>
- Roseth, C. J., Johnson, D. W., & Johnson, R. T. (2008). Promoting early adolescents' achievement and peer relationships: The effects of cooperative, competitive, and individualistic goal structures. *Psychological Bulletin, 134*(2), 223–246. <https://doi.org/10.1037/0033-2909.134.2.223>
- Rozental, A., Bennett, S., Forsström, D., Ebert, D. D., Shafran, R., Andersson, G., & Carlbring, P. (2018). Targeting procrastination using psychological treatments: A systematic review and meta-analysis. *Frontiers in Psychology, 9*, 1588. <https://doi.org/10.3389/fpsyg.2018.01588>
- Schouwenburg, H. C. (1995). Academic procrastination. Theoretical notions, measurement, and research. In J. R. Ferrari, J. L. Johnson, & W. G. McCown (Eds.), *Procrastination and task avoidance. Theory, research, and treatment.* (pp. 71–98). Plenum Press.
- Schraw, G., Wadkins, T., & Olafson, L. (2007). Doing the things we do: A grounded theory of academic procrastination. *Journal of Educational Psychology, 99*(1), 12–25. <https://doi.org/10.1037/0022-0663.99.1.12>
- Senécal, C., Lavoie, K., & Koestner, R. (1997). Trait and situational factors in procrastination. An interaction model. *Journal of Social Behavior and Personality, 12*(4), 889–903.
- Senécal, C., Julien, E., & Guay, F. (2003). Role conflict and academic procrastination: A self-determination perspective. *European Journal of Social Psychology, 33*, 135–145. <https://doi.org/10.1002/ejsp.144>
- Seta, J. J. (1982). The impact of comparison processes on coactors' task performance. *Journal of Personality and Social Psychology, 42*(2), 281–291. <https://doi.org/10.1037/0022-3514.42.2.281>
- Shaw, J. D., Duffy, M. K., & Stark, E. M. (2000). Interdependence and preference for group work: Main and congruence effects on the satisfaction and performance of group members. *Journal of Management, 26*(2), 259–279. <https://doi.org/10.1177/014920630002600205>
- Sirois, F. M., & Giguère, B. (2018). Giving in when feeling less good: Procrastination, action control, and social temptations. *British Journal of Social Psychology, 57*(2), 404–427. <https://doi.org/10.1111/bjso.12243>
- Sirois, F. M., & Tosti, N. (2012). Lost in the moment? An investigation of procrastination, mindfulness, and well-being. *Journal of Rational-Emotive & Cognitive-Behavior Therapy, 30*, 237–248. <https://doi.org/10.1007/s10942-012-0151-y>
- Solansky, S. T. (2011). Team identification: A determining factor of performance. *Journal of Managerial Psychology, 26*(3), 247–258. <https://doi.org/10.1108/02683941111112677>
- Solomon, L. J., & Rothblum, E. D. (1984). Academic procrastination: Frequency and cognitive-behavioral correlates. *Journal of Counseling Psychology, 31*(4), 503–509.
- Springer, L., Stanne, M. E., & Donovan, S. S. (1999). Effects of small-group learning on undergraduates in science, mathematics, engineering, and technology: A meta-analysis. *Review of Educational Research, 69*(1), 21–51. <https://doi.org/10.3102/00346543069001021>
- Steel, P. (2007). The nature of procrastination: A meta-analytic and theoretical review of quintessential self-regulatory failure. *Psychological Bulletin, 133*(1), 65–94. <https://doi.org/10.1037/0033-2909.133.1.65>
- Steel, P., & Ferrari, J. (2013). Sex, education and procrastination: An epidemiological study of procrastinators' characteristics from a global sample. *European Journal of Personality, 27*, 51–58. <https://doi.org/10.1002/per.1851>
- Steel, P., & Klingsieck, K. B. (2016). Academic procrastination: Psychological antecedents revisited. *Australian Psychologist, 51*(1), 36–46. <https://doi.org/10.1111/ap.12173>
- Steiner, I. (1972). *Group process and productivity.* Academic Press.
- Stevens, R. J. (2003). Student team reading and writing: A cooperative learning approach to middle school literacy instruction. *Educational Research and Evaluation, 9*(2), 137–160.
- Thürmer, J. L., Wieber, F., & Gollwitzer, P. M. (2017). Planning and performance in small groups: Collective implementation intentions enhance group goal striving. *Frontiers in Psychology, 8*, 603. <https://doi.org/10.3389/fpsyg.2017.00603>
- Tice, D. M., & Baumeister, R. F. (1997). Longitudinal study of procrastination, performance, stress, and health: The costs and benefits of dawdling. *Psychological Science, 8*(6), 454–458.

- Van der Veegt, G., Emans, B. J., & Van de Vliert, E. (2001). Patterns of interdependence in work teams: A two-level investigation of the relations with job and team satisfaction. *Personnel Psychology*, *54*, 51–69.
- Van der Veegt, G., & Janssen, O. (2003). Joint impact of interdependence and group diversity on innovation. *Journal of Management*, *29*, 729–751. [https://doi.org/10.1016/S0149-2063\(03\)00033-3](https://doi.org/10.1016/S0149-2063(03)00033-3)
- Van der Veegt, G., & Van de Vliert, E. (2001). Intragroup interdependence and effectiveness. Review and proposed directions for theory and practice. *Journal of Managerial Psychology*, *17*(1), 50–67.
- Van Eerde, W. (2003). A meta-analytically derived nomological network of procrastination. *Personality and Individual Differences*, *35*, 1401–1418.
- Van Eerde, W. (2016). Procrastination and well-being at work. In F. M. Sirois & T. A. Pychyl (Eds.), *Procrastination, health, and well-being* (pp. 233–253). Elsevier Academic Press.
- Van Eerde, W., & Klingsieck, K. B. (2018). Overcoming procrastination? A meta-analysis of intervention studies. *Educational Research Review*, *25*, 73–85. <https://doi.org/10.1016/j.edurev.2018.09.002>
- Van Hooft, E. A., & van Mierlo, H. (2018). When teams fail to self-regulate: Predictors and outcomes of team procrastination among debating teams. *Frontiers in Psychology*, *9*, 464. <https://doi.org/10.3389/fpsyg.2018.00464>
- Wageman, R. (1995). Interdependence and group effectiveness. *Administrative Science Quarterly*, *40*(1), 145–180.
- Wäschle, K., Allgaier, A., Lachner, A., Fink, S., & Nückles, M. (2014). Procrastination and self-efficacy: Tracing vicious and virtuous circles in self-regulated learning. *Learning and Instruction*, *29*, 103–114. <https://doi.org/10.1016/j.learninstruc.2013.09.005>
- Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, *54*(6), 1063–1070.
- Weber, B., & Hertel, G. (2007). Motivation gains of inferior group members: A meta-analytical review. *Journal of Personality and Social Psychology*, *93*(6), 973–993. <https://doi.org/10.1037/0022-3514.93.6.973>
- Wieland, L. M., Grunschel, C., Limberger, M. F., Schlotz, W., Ferrari, J. R., & Ebner-Priemer, U. W. (2018). The ecological momentary assessment of procrastination in daily life: Psychometric properties of a five-item short scale. *North American Journal of Psychology*, *20*(2), 315–339.

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