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The role of state and trait motivational regulation for procrastinatory behavior in academic contexts: Insights from two diary studies[☆]

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1. Introduction

Procrastination is an irrational behavior in which an intended action is voluntarily delayed, although this delay results in negative consequences (Steel, 2007). It is a widespread phenomenon in the academic context and can endanger successful studying, as it is associated with time pressure, reduced well-being, and impaired academic performance (e.g., Grunschel, Schwinger, Steinmayr, & Fries, 2016; Simpson & Pychyl, 2009). When students procrastinate, they often choose more attractive alternatives instead of their actual task, such as watching videos on the internet instead of studying (e.g., Thatcher, Wretschko, & Fridjhon, 2008). Especially in higher education, procrastination can occur frequently, as in this context high autonomy is typically granted in that students need to independently organize their learning material, choose learning goals on their own, and plan their learning procedures (see also Dresel et al., 2015). Academic procrastination presents itself as a complex phenomenon: Students procrastinate to varying degrees across time and situations (Klingsieck, Grund, Schmid, & Fries, 2013; Wäschle et al., 2014; Yerdelen, McCaffrey, & Klassen, 2016), implying substantial state fractions that should be considered when examining the construct.

Theoretically, procrastination can be conceptualized as a result of failing motivational self-regulation. We further term motivational self-regulation as *motivational regulation*, which is a conscious control of one's own motivation through the use of specific strategies (e.g., Schwinger, Steinmayr, & Spinath, 2009; Wolters, 2003). Employing such motivational regulation strategies can be considered to provide a possibility for students to overcome their procrastination—at least, research on the trait level implies that procrastination correlates negatively to a small to moderate degree with the use of certain motivational regulation strategies (e.g., Grunschel et al., 2016; Wolters & Benzon, 2013). Specifically, this research provides a first indication that different strategies may help to overcome procrastination to different degrees. This aligns with the assumption of a considerable specificity of motivational regulation—i.e., the assumption that students use different motivational regulation strategies for different motivational problem situations and these are differentially effective in overcoming these situations (Engelschalk et al., 2015, 2016). Additionally, students can be distinguished based on their (conditional) knowledge of suitable motivational regulation strategies for specific motivational problem situations (Steuer, Engelschalk, Eckerlein, & Dresel, 2019), which has been found to negatively predict academic procrastination (Bäumke, Eckerlein,

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& Dresel, 2018). Current theoretical models conceptualize motivational regulation as a strongly situation-specific process (Miele & Scholer, 2017; Schwinger & Stiensmeier-Pelster, 2012). However, there is still a lack of empirical studies addressing motivational regulation in relation to academic procrastination in concrete learning situations. For these reasons, the aim of the present research is to examine the role of motivational regulation for academic procrastination in specific learning situations in a differentiated way. Besides the extent to which motivational regulation strategies are used, we also focus on the fit of motivational regulation strategies for specific motivational problems (situation-specific fit). We examine these relations with two studies using a standardized diary approach over a longer period of time in two different university settings: The exam preparation phase as a critical learning situation, and general studying during the semester as a common learning situation.

1.1. Academic procrastination as situation-specific behavior

Academic procrastination is characterized by a voluntary delay of an intended academic action despite knowing about the negative consequences of this delay, such as reduced subjective well-being or lower academic performance (Grunschel et al., 2016; Klingsieck et al., 2013; Simpson & Pychyl, 2009; Steel, 2007; Steel & Klingsieck, 2016; Wieland et al., 2018). Despite its irrationality, it is widespread in the academic context where about 33–50% of students procrastinate (Simpson & Pychyl, 2009; Steel, 2007). To investigate procrastination, this phenomenon is typically considered from a trait perspective. Following such an approach, multiple studies have documented interconnections with personality variables, affect, and performance (Kim & Seo, 2015; Steel, 2007; Van Eerde, 2000). This trait-oriented research has yielded a large body of knowledge and showed negative relationships between procrastination and, for example, aspects of achievement motivation, such as intrinsic motivation and self-efficacy (Klassen et al., 2010; Rakes & Dunn, 2010; Steel, 2007).

However, students seem to procrastinate to a different degree over time and across situations (see Steel, 2007; Van Eerde, 2000). For instance, students have been found to procrastinate particularly often when writing a term paper, studying for exams, or reading weekly assignments (O'Brien, 2002; Prohaska, Morrill, Atilas, & Perez, 2000; Simpson & Pychyl, 2009). Further, procrastination has been found to be influenced by task aversiveness, expected outcomes, and affective as well as motivational characteristics of the situation (e.g., Lee, 2005; Pychyl, Lee, Thibodeau, & Blunt, 2000). To understand these fluctuations in academic procrastination and to reflect them adequately in empirical operationalization, it is necessary to analyze the construct not only from a trait perspective (procrastination as a tendency to generally delay doing things; Schouwenburg & Groenewoud, 2001; Tuckman, 1991), but also from a state perspective (procrastination varying across time and situations; Van Eerde, 2000). We use the term *procrastinatory behavior* to refer to state procrastination in this manuscript.

To date, studies have mostly examined procrastination with trait measures, which do not account for the state variability of this construct (e.g., Steel, Svartdal, Thundiyil, & Brothen, 2018; Tice & Baumeister, 1997). There are only a handful of empirical contributions on state changes of academic procrastinatory behavior (e.g., Wäschle et al., 2014; Yerdelen et al., 2016). These studies suggest that students differ in their levels and temporal trends of academic procrastinatory behavior during the semester. While Yerdelen et al. (2016) found that academic procrastinatory behavior generally increases during the semester, Wäschle et al. (2014) study indicates that academic procrastinatory behavior decreases the closer an exam gets and increases again thereafter. This latter finding is in line with temporal motivation theory that includes time as a critical motivational factor (Steel & König, 2006), implying lower procrastinatory behavior the closer a deadline gets. Similarly, it has been found that the closer a deadline or exams gets, the more time students dedicate to studying each day (Dewitte &

Schouwenburg, 2002). Hence, students can be expected to be able to overcome their academic procrastinatory behavior under certain circumstances.

Taken together, academic procrastination should be conceptualized as a (partly) state-specific behavior and is not only associated with global dispositions, but also with state factors such as temporal or situational prerequisites (Brownlow & Reasinger, 2000; Wieland et al., 2018). Therefore, it is necessary to take a closer look at state academic procrastinatory behavior to understand its fluctuations over time and its precursors—for example, in terms of more or less effective endeavors to regulate one's own motivation.

1.2. Motivational regulation: Strategy use and strategy fit

From a general self-regulatory perspective, motivational regulation—a conscious control of one's own motivation in order to initiate, maintain, or enhance it (e.g., Schwinger et al., 2009; Wolters, 2003)—includes: conditions (current assessment of one's motivation as a result of self-monitoring), operations (strategies to regulate one's motivation) and standards (certain criteria or norms which provide the desired target state of motivation). Therefore, motivational regulation can be considered a dynamic process (Winne & Hadwin, 2012). Based on this general notion, the metamotivational model of motivational regulation by Miele and Scholer (2017) conceptualizes the dynamic process of motivational regulation in more detail with cyclical loops that are repeatedly passed in achievement situations such as studying. Thereby, the authors emphasize the underlying processes of metamotivational monitoring of motivational regulation (how and when students become aware of a motivational problem, how they know which motivational regulation strategy is best suited for the current motivational problem) and address motivation components that correspond to a unique set of motivational regulation strategies. The process perspective of Miele and Scholer (2017) also converges in central assumptions with the motivational regulation model by Schwinger and Stiensmeier-Pelster (2012) that includes a monitoring phase (encompassing the perception of low motivation, followed by a need for higher motivation, and identification of reasons for motivational problems) that leads to the motivational regulation phase (in which strategies are applied). In both models, motivational regulation strategies play an essential role as facilitators of one's motivation. To this end, much work has focused on the following set of strategies (e.g., Engelschalk, Steuer, & Dresel, 2015; Schwinger et al., 2009; Steuer et al., 2019; Wolters & Rosenthal, 2000) that were also included in the present work: Enhancement of personal significance (increase awareness of the connection between the learning material and one's own life), enhancement of situational interest (increase appeal of the learning material), mastery self-talk (increase awareness of the importance of learning), performance-approach self-talk (increase awareness of positive reactions following a good performance, i.e., external incentives, such as good grades), self-consequating (independently set positive incentives), environmental control (reduction of distracting factors), performance-avoidance self-talk (increase awareness of negative reactions following a poor performance, e.g., bad grades), proximal goal setting (break a task down into smaller pieces with the aim of making it more manageable) and ability-focused self-talk (increase awareness of one's own skills, or remind oneself of successful mastery of similar situations in the past). However, recent studies identified the strategy of performance-avoidance self-talk as a rather unproductive strategy, as it is positively related to dysfunctional learning behaviors (e.g., Grunschel et al., 2016). Hence, this strategy should not be included in an overall strategy use score.

So far, research on motivational regulation has primarily used two measurement approaches with different underlying assumptions: global self-report scales (e.g., Schwinger et al., 2009; Schwinger & Stiensmeier-Pelster, 2012; Wolters, 1999; Wolters & Benzion, 2013), and strategy knowledge tests (e.g., Steuer et al., 2019). With global self-report scales, motivational regulation is investigated as a habituated behavior and the

frequency or degree of the use of motivational regulation strategies is typically assessed (*strategy use*). However, not every strategy is useful in every motivationally critical situation. From an expectancy-value perspective, situations can be considered as motivationally critical if they are perceived as too difficult (e.g., complicated or difficult to understand) or as irrelevant (e.g., uninteresting or of little significance; e.g., Sansone & Thoman, 2006; Schwinger et al., 2009; Wolters, 1999). Further, motivational problems can be pre-actional (to initiate motivation) or actional (to maintain motivation, e.g., Engelschalk et al., 2015; Engelschalk, Steuer, & Dresel, 2016; Wolters & Rosenthal, 2000). In consequence, given the specific task demands, a unique set of strategies appears suitable for specific motivational problems (Miele & Scholer, 2017; Scholer & Miele, 2016). Hence, motivational regulation strategies can be considered to be effective in a context-specific way and to fit different motivational problems to varying degrees (*strategy fit*; see Pintrich, 2000; Schwinger & Stiensmeier-Pelster, 2012; Wolters, 2003; Wolters & Rosenthal, 2000). Building on this notion, strategy knowledge tests assess students' conditional knowledge about which motivational regulation strategies are appropriate for which specific motivational problems. Results of a study by Steuer et al. (2019), integrating both measurement approaches, indicated that both strategy use and strategy fit are unique aspects of motivational regulation that are specifically relevant for the effectiveness of the regulatory attempts and subsequent learning behavior.

1.3. Motivational regulation and academic procrastination

As procrastination can theoretically be conceptualized as a result of failing motivational regulation (e.g., Schwinger et al., 2009; Wolters, 2003), it can be understood as a primarily motivational problem. In light of this, several studies confirm negative relationships between different aspects of students' motivation and procrastination (e.g., Klassen & Kuzucu, 2009; Lee, 2005; Rakes & Dunn, 2010; Schouwenburg & Groenewoud, 2001). On a more general level, motivational regulation can be considered crucial for successful studying, as students need to regulate their motivation to achieve their study-related goals (Engelschalk et al., 2016). Particularly in their first year at university, students frequently experience a deterioration in their achievement motivation

over the course of a semester, and low motivation can lead to lower academic success—including lower achievement and higher dropout intentions (Schnettler et al., 2020). Therefore, motivational regulation can be considered especially relevant in order to counteract this decrease in motivation. Taken together, motivational regulation can function as a protective factor against deterioration of motivation and as a key to overcoming academic procrastination.

So far, both aspects—strategy use and strategy fit of motivational regulation—have been used in isolation from each other to predict procrastination in past research (e.g., Bäumke et al., 2018; Grunschel et al., 2016; Wolters & Benzon, 2013). Specifically, studies indicated that increased strategy use may have a buffering effect against procrastination. For instance, Wolters and Benzon (2013) analyzed the relations between six motivational regulation strategies and procrastination in a college population and found differences in the extent of students' reported strategy use, which was negatively associated with procrastination. Grunschel et al. (2016) reported similar findings and additionally highlighted a positive effect of strategy use on subjective well-being and academic performance via reduced academic procrastination. Furthermore, the results of this study underscored the assumption that not every strategy works equally well for overcoming motivational problems: For example, the strategy of performance-avoidance self-talk (to increase awareness of negative reactions following a poor performance, e.g., bad grades) was found to be rather dysfunctional in that it went along with increased academic procrastination (Grunschel et al., 2016; Schwinger & Stiensmeier-Pelster, 2012). Further, Bäumke et al. (2018) examined conditional knowledge about the fit of the various motivational regulation strategies for specific motivational problem situations in relation to academic procrastination. They found that this type of strategy knowledge is positively related to the effectiveness of motivational regulation, which in turn was negatively related to academic procrastination and college dropout intentions. Taken together, the existing research on the pertinence of motivational regulation for overcoming academic procrastination implies that both strategy use and strategy fit might be of relevance (see Fig. 1).

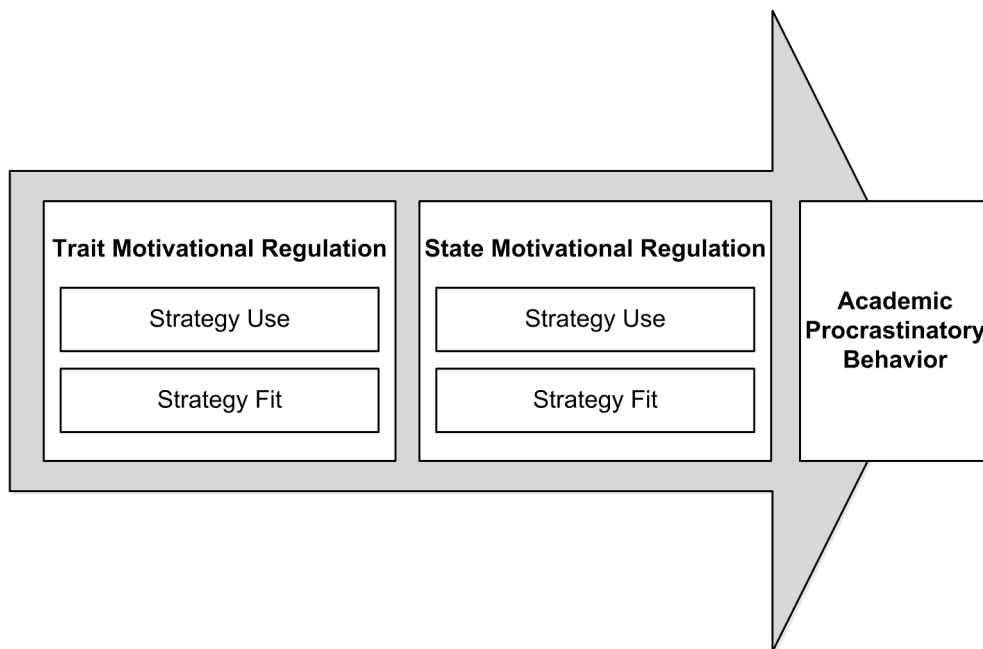


Fig. 1. Theoretical model on the differentiation of motivational regulation between strategy use as well as strategy fit on a trait and state level in connection with academic procrastinatory behavior.

1.4. Motivational regulation as a situated state process

The before mentioned metamotivational model by Miele and Scholer (2017) strongly emphasizes the processes by which students regulate their motivational states. This shows that motivational regulation has situation-specific aspects that should be considered on a state-level. Thereby, it stands to reason that both strategy use and strategy fit have time and situation-specific qualities. For instance, students might use a different amount of motivational regulation strategies on different days of studying. Additionally, it has been argued that students use different motivational regulation strategies in different situations (Grunschel et al., 2016; Wolters & Benzon, 2013; Wolters & Rosenthal, 2000). We argue that motivational regulation has state qualities with regard to both strategy use and strategy fit, which both refer, from a functional perspective, to the psychological processes that are responsible for the intended initiation, maintenance, or enhancement of motivation, i.e., for the intended effects of motivational regulation. This notion implies that addressing state motivational regulation could serve as a step forward in understanding procrastinatory behavior that is embedded in specific academic situations.

Up to this point, this state conceptualization of motivational regulation strategy use and strategy fit has hardly found its way into empirical research. However, as argued above, it is crucial to distinguish in motivational regulation between trait strategy use and trait strategy fit while at the same time taking state strategy use and state strategy fit into account to understand their influence on academic procrastinatory behavior. We present two studies as a step in that direction by allowing a dual consideration of state and trait motivational regulation in association with academic procrastinatory behavior. As displayed in Fig. 1, we aim to address the abovementioned strategy use and strategy fit from a trait level mirrored to a state level and examine its relations to academic procrastinatory behavior.

1.5. The current research

Research on motivational regulation has predominately focused on the extent of strategy use (e.g., Schwinger et al., 2009; Wolters & Rosenthal, 2000), but recent work has also considered strategy fit (e.g., Engelschalk et al., 2016; Steuer et al., 2019). Besides the mere use of motivational regulation strategies, fit aspects of motivational regulation strategies can account for an additional explanatory value. Furthermore, trait aspects of motivational regulation might function as underlying dispositions for students to regulate their motivation each day. Therefore, we argue that it is necessary to differentiate between strategy use and strategy fit on a trait as well as on a state level in order to elucidate the linkages between motivational regulation and academic procrastinatory behavior. To the best of our knowledge, no studies have examined the interrelations of motivational regulation and academic procrastinatory behavior in a differentiated way with situation-specific designs. The aim of the present research was therefore to investigate the relationship between these constructs by examining academic procrastinatory behavior over time in specific learning situations. To this end, we conducted two longitudinal diary studies. This approach allows us to record specific learning behaviors and interpret them in a valid way (Schmitz & Wiese, 2006). First, we examined motivational regulation on a trait level in terms of habituated use of strategies (*trait strategy use*) and conditional motivational regulation strategy knowledge (*trait strategy fit*). On a state level, we mirrored the concepts and adapted the measures of strategy use and strategy fit of motivational regulation to apply them situation-specifically to a learning diary (*state strategy use* and *state strategy fit*). In order to address critical as well as common academic settings, we examined the relations between motivational regulation and academic procrastinatory behavior during one month in an exam preparation phase (Study 1) and during seven weeks of a semester (Study 2).

Following the research of Wäschle et al. (2014) and Yerdelen et al.

(2016) on fluctuations of academic procrastinatory behavior in the course of studying, we sought to confirm in both studies that there are substantial inter-individual differences in the trajectories—meaning the temporal development of academic procrastinatory behavior over time (Hypothesis H1). Specifically, we expected a decrease of academic procrastinatory behavior during the exam preparation phase (Study 1), but an increase of academic procrastinatory behavior during the semester in general (Study 2).

As research from Grunschel et al. (2016) and Wolters and Benzon (2013) suggests a negative relationship between motivational regulation strategy use and procrastination, we next assumed that trait strategy use as well as state strategy use are negatively associated with academic procrastinatory behavior (Hypothesis H2). Additionally, we took a closer look at the effects of trait strategy use on the trajectories of academic procrastinatory behavior for expanding the research field.

Following the findings of Baulke et al. (2018) on the negative relationship between trait strategy fit—in terms of conditional motivational regulation strategy knowledge—and procrastination, we hypothesized that trait strategy fit as well as state strategy fit are negatively associated with academic procrastinatory behavior (Hypothesis H3). Again, we additionally took a closer look at the effects of trait strategy fit on the trajectories of academic procrastinatory behavior.

Finally, we combined these two differentiations of motivational regulation, and assumed that strategy use and strategy fit on a trait level are negatively related to the levels and positively to the gradient of the trajectories of academic procrastinatory behavior, meaning that a frequent trait strategy use, as well as high trait strategy fit, should be accompanied by lower levels, as well as by more favorable trajectories of academic procrastinatory behavior. Additionally, we expected strategy use and strategy fit on a state level to be negatively related to academic procrastinatory behavior (Hypothesis H4).

2. Study 1

2.1. Procedure and participants

In Study 1, we collected data beginning with a pretest one week before the exam period, followed by a total of 28 daily End-of-Day diaries during one month of the exam period. On average it took 4.6 min ($SD = 3.9$) to complete the daily assessments, which is in line with the recommendations by Reis and Gable (2000) regarding diary design and study compliance. Students had to answer the diary within 24 h after receiving the link, and could receive up to 50 Euros, depending on their participation.

We recruited the participants by advertising the study in central lectures of mathematics and economic sciences at a German university. Overall, 250 students signed up for an invitation to the study. Thereof, 160 students (53% female, 47% male) with a mean age of 21.7 years ($SD = 2.2$) completed the pretest. They were mainly enrolled in mathematics (22%), and economics (63%), and were mainly 1st (38%), 2nd (34%) and 3rd (14%) year students. On average, they completed 79% of the diaries. Our ex ante criterion for including data in our analyses was that students completed at least 10 out of 28 End-of-Day diaries in addition to the pretest. Consequently, our final sample consisted of 128 students who fulfilled the criterion and we received in total 3,121 single measurements that were included in our analyses.

2.2. Measures

Table 1 presents an overview of the included measures, indicating good internal consistencies of all measures.

We assessed motivational regulation on the trait level (in the pretest) with a short version of an instrument by Steuer et al. (2019) that allows strategy use and strategy fit to be measured with a Situational Judgement Test alongside five standardized vignettes, describing representative motivational problems while studying. Detailed information on this

Table 1

Descriptive Statistics, Internal Consistencies, and Bivariate Correlations Between Motivational Regulation and Procrastination (Study 1).

	<i>M</i>	<i>SD</i>	α	Rangae		Skew	ICC	Bivariate correlations			
				Potential	Actual			1	2	3	4
<i>Person level (pretest measures, N = 128)</i>											
1 MR: Trait strategy use	4.44	0.87	0.90	1–6	1.00–5.90	–1.13					
2 MR: Trait strategy fit	1.97	1.01	0.94	–5–5	–2.64–3.95	–1.10		0.30**			
<i>Situational level (daily measures, N = 3,121)</i>											
3 MR: State strategy use	3.80	1.34	0.85	1–5	1.00–5.00	–1.29	0.21	0.29**	0.11		
4 MR: State strategy fit	–0.17	1.68	0.98	–4–4	–4.00–3.67	–0.26	0.29	0.12	0.21*	0.17	
5 Academic procrastinatory behavior	2.21	1.15	0.85	1–5	1.00–5.00	0.13	0.23	–0.15	–0.35**	0.14	–0.34**

Notes. MR = Motivational regulation. State measures were aggregated on the person level to calculate bivariate correlations. ** $p < .01$, * $p < .05$.

instrument is provided in an [electronic supplement](#). An example vignette reads as: “You are faced with the task of writing a term paper. Therefore, you have to independently search for literature and write an academic text for a specific deadline. The content you have to work with is boring (e.g., uninteresting, scarcely useful, not important). This is why you are not motivated to begin”.

For assessing trait strategy use, we asked students with regard to each of the vignettes in an open-ended question to name a strategy that they would most likely use to regulate their motivation and how often they use this strategy. To this end, we used two items (e.g., “I often use this strategy in the abovementioned situation”) that were answered on a Likert-type response scale ranging from 1 (*disagree completely*) to 6 (*agree completely*). We calculated the trait strategy use score through a two-step calculation of mean scores: First, we calculated a mean score of the two items within each vignette and then we calculated a mean score of these across vignettes. The internal consistencies reported in [Table 1](#) refer to the scores across vignettes.

To measure trait strategy fit, students were subsequently presented with nine different motivational regulation strategies (enhancement of situational interest, enhancement of personal significance, mastery self-talk, performance-approach self-talk, performance-avoidance self-talk, environmental control, self-consequating, proximal goal setting, ability-focused self-talk). Participants were asked to rate these strategies according to their suitability regarding the five different situations presented in the vignettes on a Likert-type scale ranging from 1 (*not suitable at all*) to 6 (*completely suitable*). Using the procedure developed by [Steuer et al. \(2019\)](#), the final test score used in our analyses was calculated by comparing students’ suitability ratings with expert ratings. Specifically, following [Steuer et al. \(2019\)](#), 22 pair comparison scores were calculated that were averaged into the final test score with high scores representing large conditional motivational regulation knowledge. Such a testing approach has already been broadly empirically validated in self-regulated learning research (e.g., [Maag Merki, Ramseier, & Karlen, 2013](#)).

To assess state use of motivational regulation strategies on a daily basis in the diary, we used nine items ([Engelschalk et al., 2015](#); [Schwinger et al., 2009](#)) that best represented the above mentioned nine common motivational regulation strategies. They were slightly adapted to the daily context through a change of the item stem (that now reads as: “For improving my motivation today...”). An example item reads as: “... I told myself that I should keep learning in order to learn as much as possible for me personally”. The Likert-type response scale ranged from 1 (*not correct at all*) to 5 (*fully correct*). It can be assumed that in a specific learning situation, students use some motivational regulation strategies to a greater extent than others (i.e., they typically only use a single strategy or, sometimes, a combination of a few strategies to address their current motivational problem). Therefore, we argue that the average score of the strategy use ratings for all known regulation strategies does not represent strategy use in specific situations well. Instead, we used the maximum score of these strategy use ratings that better represents the extent to which students use motivational regulation strategies in specific situations, as it focuses only on the specific strategies the

individuals are focusing on and is independent of the number of used strategies.

As the fourth and final aspect of motivational regulation, state strategy fit was assessed by compiling a fit score based on the ratings for the nine state items assessing the situation-specific use of motivational regulation strategies described above. Analogously to the determination of trait fit, we calculated the situation-specific fit of these strategies by comparing them against the expert standards on the suitability of the presented strategies for specific motivational problems provided by [Steuer et al. \(2019\)](#). To assess the nature and extent of a current motivational problem in the specific situation, we used four items in the diary representing typical motivational problems ([Engelschalk et al., 2016](#)). The item stem was adapted to the daily context (“Today, I was unmotivated ...”) and the items read as: “... to study, because the content was too difficult” (expectancy problem), “... to study, because the content was too boring” (value problem), “... to begin studying” (problem to initiate motivation), and “... to keep studying” (problem to maintain motivation). The items were presented on a Likert-type response scale ranging from 1 (*disagree completely*) to 6 (*agree completely*). To compile the overall fit score, we calculated separate fit scores for the four motivational problem situations, and then multiplied them with the manifestation of the abovementioned motivational problems (we provide a detailed description of this procedure in the [electronic supplement](#)). Higher values of the fit score represent a better situation-specific fit of the daily chosen strategies.

To assess academic procrastinatory behavior, we used two items of the German version of the Tuckman Procrastination Scale (TPS, [Stöber & Joormann, 2001](#); see also [Tuckman, 1991](#)) that we slightly adapted to the daily academic context. Using two items has the advantage of a better representation of the construct (concerning validity) and a better assessability of their reliability compared to the single item approach that is common in diary studies (e.g., [Brose, Schmiedek, Lövdén, & Lindenberger, 2012](#); [Gogol et al., 2014](#); [Goetz et al., 2014](#)). The two items were selected from the original scale by representation of the construct (the items cover an intention-action gap, refer to a voluntary delay despite expecting to be worse off for the delay, see [Steel, 2007](#)), factor loadings (using items with high, positive factor loadings), and comprehensibility (the items are well-understandable with regard to daily assessments). Meeting these criteria, the two items are: “Today, I did not get into the exam preparation, even though I know how important it is to get started” and “Today, I promised myself to get into exam preparation, but then dragged my feet”. The Likert-type response scales ranged from 1 (*not correct at all*) to 5 (*fully correct*).

2.3. Analyses

We tested our hypotheses by conducting growth curve modeling following a two-level approach (daily measurement points nested in individual students) using Mplus 7 ([Muthén & Muthén, 1998–2012](#)). There are two possible forms of missing data in the current study: Missing full days and missing values on the item level. To also include students who had missed some entries and still conduct meaningful

analyses, we chose the above mentioned ex-ante criterion to deal with missing full days. We examined if the number of participated End-of-Day diaries was associated with the variables of the current study: Not surprisingly, participation rate correlated negatively but only slightly with academic procrastinatory behavior ($r = -0.08$; $p < .01$). Additionally, it correlated positively with trait strategy use ($r = 0.20$; $p < .01$) and trait strategy fit ($r = 0.14$; $p < .01$) and slightly negatively with state strategy fit ($r = -0.08$; $p < .05$). Hence, missing full days do not seem to occur at random—which is unsurprising in this research area as there is always some kind of self-selection (Robins, Rotnitzky, & Scharfstein, 2000). Students stating rather high motivational regulation also completing more diaries in the beginning and then sequentially dropping out could affect the mean slope value of procrastinatory behavior, meaning that the decrease of procrastinatory behavior over time might be underestimated. However, the low correlations imply that such an effect might be rather small and this mean slope value of academic procrastinatory behavior was not the main focus of the study. In order to rule out that our results are substantially affected by the occurrence of missing days, we repeated all analyses in two variants: First, with the number of participated days as a control variable and, second, using all students who participated in the pretest (i.e., without applying the above mentioned ex ante criterion). In both cases, all results from our main analyses remained stable. Missing values on the item level were imputed using the full information maximum likelihood (FIML) approach during model estimation in Mplus (Muthén & Muthén, 1998–2012).

We first estimated unconditional means models for our state variables to determine the extent of inter-individual and intra-individual differences. Afterwards, we estimated an unconditional growth model (Model 1) to examine if there were inter-individual differences in the trajectories of academic procrastinatory behavior by adding a time variable that was centered on the day of the earliest exam (test of H1). In the next step, we estimated two separate models to investigate the role of motivational regulation for academic procrastinatory behavior. Specifically, Model 2 included trait strategy use as a trait predictor and state strategy use as a state predictor of academic procrastinatory behavior over time (test of H2). Additionally, we modeled the effect of trait strategy use on state strategy use. In Model 3, we investigated trait strategy fit as a trait predictor and state strategy fit as a state predictor of academic procrastinatory behavior over time (test of H3). Again, we additionally modeled the effect of trait strategy fit on state strategy fit. Finally, we included all state and trait predictors in one model (Model 4) and additionally included the effect of trait strategy use on state strategy use as well as of trait strategy fit on state strategy fit in order to determine their combined influence on academic procrastinatory behavior (test of H4). In all analyses, we estimated linear trends of the trajectories.¹

2.4. Results and discussion

In Table 1, we present descriptive statistics and bivariate correlations. Results of unconditional means models revealed substantial proportions of variance within persons in academic procrastinatory behavior, motivational regulation state strategy use, as well as state strategy fit: For academic procrastinatory behavior, 23% of the variance ($ICC = 0.23$, $SE = 0.03$, $p < .001$), for state strategy use 21% of the variance ($ICC = 0.21$, $SE = 0.03$, $p < .001$), and for state strategy fit 29% of the variance ($ICC = 0.29$, $SE = 0.06$, $p < .001$) could be attributed to stable differences between students. Hence, not only academic procrastinatory behavior, but also motivational regulation state strategy use and state strategy fit fluctuate considerably across time and situations. This confirms the basic premise of the present work and suggests, in line with Miele and Scholer (2017), a closer examination of the state process

is needed to understand this intra-individual variability. Trait strategy fit, and state strategy fit correlated negatively with academic procrastinatory behavior. Surprisingly, trait strategy use and state strategy use did not correlate statistically significantly with academic procrastinatory behavior. Hence, mere strategy use did not relate to academic procrastinatory behavior, but state strategy fit did.

We first examined if there were substantial inter-individual differences in the trajectories of academic procrastinatory behavior. An unconditional growth model that included time centered on the day of the earliest exam as a Level 1 predictor (see Table 2, Model 1) revealed a small, significant slope variance of the time variable, indicating inter-individual differences between students in the development of academic procrastinatory behavior over the exam period. This result confirms our basic hypothesis (H1) and allows us to further investigate the trajectories of academic procrastinatory behavior. Additionally, there was a moderate average linear decrease of academic procrastinatory behavior during the exam period. Based on these findings, we sought to explain the inter-individual differences in the extent and the intrapersonal changes in academic procrastinatory behavior from the different aspects of motivational regulation.

Thus, we next examined the influence of motivational regulation strategy use on academic procrastinatory behavior (see Table 2, Model 2). Results indicated a small negative effect of trait strategy use on the level of academic procrastinatory behavior, but no statistically significant effect on its trajectories. State strategy use had no statistically significant effect on academic procrastinatory behavior. Trait strategy use positively predicted the person-stable fractions of state strategy use to a moderate degree ($\beta = 0.15$; $p < .01$). This result partly confirms our second hypothesis, as a large habituated use of motivational regulation strategies is associated with reduced academic procrastinatory behavior.

Subsequently, we examined the influence of motivational regulation strategy fit on academic procrastinatory behavior (see Table 2, Model 3). Here, trait strategy fit negatively predicted the level of academic procrastinatory behavior to a moderate degree. Additionally, trait strategy fit had a small negative effect on the slope of its trajectories—indicating that a better trait fit of motivational regulation strategy use was associated with a stronger or faster reduction of academic procrastinatory

Table 2

Results of Growth Curve Modeling of Academic Procrastinatory Behavior, Predicted by Motivational Regulation (Study 1).

Parameter	Model 1	Model 2	Model 3
Fixed Effects			
Person level			
Intercept			
MR: Trait strategy use		-0.07* (0.04)	
MR: Trait strategy fit			-0.19*** (0.05)
Slope			
MR: Trait strategy use		-0.01 (0.03)	
MR: Trait strategy fit			-0.06** (0.02)
Situational level			
MR: State strategy use		-0.00 (0.04)	
MR: State strategy fit			-0.44*** (0.04)
Time in days	-0.16*** (0.03)	-0.16* (0.03)	-0.15*** (0.03)
Random parameters			
Person level			
$Var(r_{0i})$	0.21*** (0.03)	0.28*** (0.04)	0.18*** (0.03)
$Var(r_{1i})$	0.05*** (0.01)	0.05*** (0.01)	0.04*** (0.01)
Situational level			
$Var(e_{ij})$	0.71*** (0.04)	0.71** (0.04)	0.58*** (0.03)

Notes. $N_{person\ level} = 128$, $N_{situational\ level} = 3,109$. MR = Motivational regulation. Time in days was centered on the day of the first exam. Parameters can be interpreted as standardized regression weights. Standard errors are presented in parentheses. $Var(r_{0i})$ indicates the residual between-person variance of academic procrastinatory behavior; $Var(r_{1i})$ estimates the (residual) between-person variance of the slope of the linear trajectories of academic procrastinatory behavior; $Var(e_{ij})$ indicates the residual within-person variance of academic procrastinatory behavior. *** $p < .001$, ** $p < .01$, * $p < .05$.

¹ Testing for non-linear trends (quadratic and cubic) did not account for further explained variance.

behavior over the exam preparation phase. State strategy fit negatively predicted academic procrastinatory behavior to a moderate degree. Trait strategy fit positively predicted the person-stable fractions of state strategy fit to a moderate degree ($\beta = 0.19$; $p < .01$). The results are in line with our third hypothesis, as better conditional knowledge regarding the suitability of motivational regulation strategies to various motivational problems on a trait level as well as the actual fit of the chosen regulations strategies to the problem at hand on a state level are associated with reduced academic procrastinatory behavior and more favorable developments of this dysfunctional behavior.

The results for the combined conditional growth curve model (Model 4) are presented in Fig. 2. The findings show that the trait use of motivational regulation strategies predicted the actual state use of these strategies and, analogously, the trait fit of these strategies also predicted the state fit. Furthermore, trait strategy use correlated positively with trait strategy fit and state strategy use correlated positively with state strategy fit, both to a moderate degree. While no statistically significant effect on the level and trajectories of academic procrastinatory behavior was evident for the trait strategy use in this model, trait strategy fit negatively predicted both the extent of academic procrastinatory behavior (moderate effect) as well as the slope of its trajectories (small effect). State strategy use showed a moderate effect on academic procrastinatory behavior—which was unexpectedly in a positive direction. State strategy fit had a strong effect on academic procrastinatory behavior in the expected negative direction. For testing the robustness of the results, we additionally added participation rate as well as students' semester, gender and major as control variables to the model. All effects remained significant and the estimation of the parameters remains on a descriptive level very similar². Hence, it seems well justified to assume that the results are not biased by specific characteristics of the sample regarding participation rate or the demographics of semester, gender and major. Taken together, results partly confirm our fourth hypothesis, as strategy fit, on a trait as well as on a state level, had a beneficial effect on academic procrastinatory behavior.

In conclusion, our hypotheses could largely be confirmed in Study 1. In line with Grunschel et al. (2016) and Wolters and Bizon (2013), trait strategy use had a small reducing effect on the level of academic procrastinatory behavior. Trait strategy fit as well as state strategy fit had a moderate to high reducing effect on the level as well as the trajectories of academic procrastinatory behavior, which aligns with findings of B  ulke et al. (2018). In the combined model, the effect of trait strategy use vanished, but surprisingly state strategy use increased academic procrastinatory behavior. This result can either be due to suppression effects (see negative suppression; Lubin, 1957), or it might indicate that after controlling for fit aspects of motivational regulation, mere strategy use is rather obstructive for reducing academic procrastinatory behavior. However, to rule out measurement issues, as we used a rather uncommon measurement for motivational regulation strategy use incorporating an open-ended format, we investigated these effects in Study 2 with the more common measure for motivational regulation strategy use by Schwinger, von der Laden, and Spinath (2007).

3. Study 2

3.1. Procedure and participants

Study 2 was conducted in a similar way to Study 1 including a pretest and diaries. Differently to Study 1, we collected data in the middle of a semester with weekly diaries during a period of seven weeks. Students

had to answer the diaries within 24 h after receiving them, and could receive up to 35 Euros, depending on their participation.

We recruited participants by advertising the study in central lectures of teacher education studies in a university in southern Germany. The prerequisite for participation was that students attended a university course that fulfilled the following criteria: The course comprised two hours per week during the semester, required weekly assignments with at least one hour of additional workload per week, and was perceived as demanding and/or complex by the students. The participants could choose the course themselves and had to name it in the pretest and all weekly diaries referred to it. Invitations to the diaries were sent out on the day that the class took place, so that participants could refer to their studying during the previous week regarding this course. Overall, 378 students signed up for an invitation to the study. Thereof, 233 students (90% female, 9% male, 1% diverse) with a mean age of 20.7 years ($SD = 2.9$) completed the pretest. They were enrolled in primary school education (68%) and secondary school education (32%) and were mainly in their 1st (49%), 2nd (34%) and 3rd (5%) year. On average, students completed 89% of the diaries. Our ex ante criterion for including data in our analyses was that students completed at least 3 out of 7 weekly diaries in addition to the pretest. Consequently, our final sample consisted of 218 students who fulfilled this criterion and we received in total 1,450 single measurements that were included in our analyses.

3.2. Measures

Table 3 presents an overview of the included measures, indicating good internal consistencies of all measures. Study 2 included nearly the same measurements as Study 1.

We assessed trait strategy use in the pretest with the motivational regulation questionnaire by Schwinger et al. (2007), supplemented by four items on the strategy of ability-focused self-talk by Engelschalk et al. (2015). In doing so, we focused on the same nine motivational regulation strategies as in Study 1. An example item reads as: "I tell myself that I should keep learning in order to learn as much as possible for me personally". The Likert-type response scale ranged from 1 (*very rarely*) to 5 (*very often*). We compiled one single score of the overall 31 items that reflects the extent of motivational regulation strategy use (as the strategy of performance-avoidance self-talk is regarded as maladaptive, it was excluded from the overall motivational regulation strategies score; see Grunschel et al., 2016; Schwinger & Otterpohl, 2017).

Trait strategy fit was assessed like in Study 1.

State strategy use was assessed in a similar way to Study 1, but in relation to the course that students named in the pretest (reflected in the item stem: "For improving my motivation last week in regard to [name of the course], ..."). An example item reads as: "... I told myself that I should keep studying in order to learn as much as possible for me personally".

To examine the state strategy fit, we adapted the items mentioned in Study 1 with regard to a specific course as well and compiled an overall fit score in the same way as we did in Study 1.

Academic procrastinatory behavior was measured in a course-related way as well (reflected in the question: "How was your last week regarding [name of the course]?"). Then, the two procrastination items already used in Study 1 were presented (e.g., "Last week, I did not get into the exam preparation, although I know how important it is for me to get started").

3.3. Analyses

We conducted the same analyses as in Study 1. As in Study 1, there are two possible forms of missing data (missing full days and missing values on the item level). Participation in the End-of-Day diaries was not substantially related to students' responses regarding the variables of interest. Only trait strategy use correlated slightly negative with

² Additionally, we also included interaction terms of the study major on the one hand and trait strategy use or trait strategy fit, on the other hand. This did not reveal any significant interaction effect on procrastinatory behavior—indicating that there were no dependencies of the effects on students' study major.

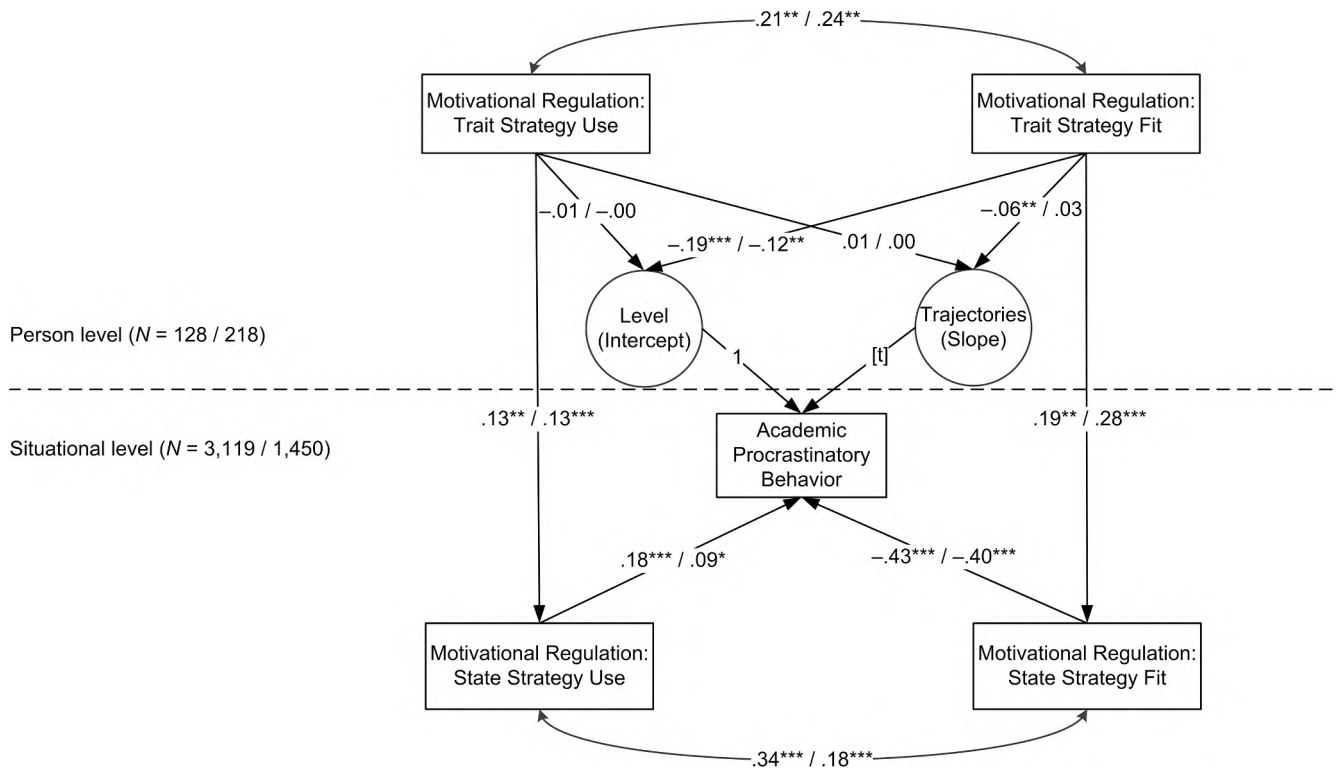


Fig. 2. Final two-level model of the effects of motivational regulation on academic procrastinatory behavior. Results of Study 1 are displayed on the left side of the slashes, results of Study 2 are displayed on the right side of the slashes. *** $p < .001$, ** $p < .01$, * $p < .05$.

Table 3
Descriptive Statistics, Internal Consistencies, and Bivariate Correlations of the Measurements (Study 2).

	<i>M</i>	<i>SD</i>	α	Range		Skew	ICC	Bivariate correlations			
				Potential	Actual			1	2	3	4
<i>Person level (pretest measures, N = 218)</i>											
1 MR: Trait strategy use	4.34	0.91	0.88	1–6	1.00–6.00	–1.07					
2 MR: Trait strategy fit	2.18	1.08	0.92	–5–5	–1.23–4.36	–0.54		0.18**			
<i>Situational level (daily measures, N = 1,450)</i>											
3 MR: State strategy use	4.09	1.04	0.82	1–5	1.00–5.00	–1.48	0.29	0.27**	0.25**		
4 MR: State strategy fit	–0.30	1.68	0.98	–4–4	–4.00–4.00	–0.21	0.43	0.15**	0.56**	0.63**	
5 Academic procrastinatory behavior	2.57	1.20	0.87	1–5	1.00–5.00	0.33	0.35	–0.07	–0.20**	–0.16**	–0.47**

Notes. MR = Motivational regulation. State measures were aggregated on the person level to calculate bivariate correlations. ** $p < .01$.

participation rate ($r = -0.05$; $p < .05$). Like in Study 1, we repeated all analyses in two variants (participation rate as an additional control variable and using all students that participated in the pretest) to rule out that the results are biased by missing days. In both cases, all results remained largely stable. Missing values on the item level were imputed via the full information maximum likelihood (FIML) approach (Muthén & Muthén, 1998–2012). In order to interpret the temporal effect of academic procrastinatory behavior similarly to Study 1, the time variable was centered on the middle of the diary period.

3.4. Results and discussion

In Table 3, we present descriptive statistics, internal consistencies and bivariate correlations. Similarly to Study 1, the results of the unconditional means model revealed substantial proportions of variance within persons in academic procrastinatory behavior, motivational regulation state strategy use, as well as state strategy fit: For academic procrastinatory behavior 35% of the variance (ICC = 0.35, SE = 0.04, $p < .001$), for state strategy use 29% of the variance (ICC = 0.29, SE = 0.04, $p < .001$), and for strategy fit 43% of the variance (ICC = 0.43, SE = 0.08, $p < .001$) could be attributed to stable differences between

students. Hence, these findings are in line with Study 1, as not only academic procrastinatory behavior, but also motivational regulation state strategy use and state strategy fit fluctuate considerably across time and situations. Similar to Study 1, trait strategy fit, state strategy use, and state strategy fit correlated negatively with academic procrastinatory behavior. The correlation between trait strategy use and academic procrastinatory behavior was negative, but not statistically significant.

We subsequently examined if there were substantial inter-individual differences in the trajectories of academic procrastinatory behavior. As in Study 1, the results of an unconditional growth model that included time centered on the middle of the diary period as a Level 1 predictor (see Table 4, Model 1) revealed a small, significant effect of the slope variance of time between students. This result confirms, in addition to the findings of Study 1, our basis hypothesis (H1) and allows us to further investigate inter-individual differences in academic procrastinatory behavior in relation to the different aspects of motivational regulation.

Based on that, we next examined the influence of motivational regulation strategy use on academic procrastinatory behavior (see Table 4, Model 2). Neither trait strategy use nor state strategy use had a

Table 4

Results of Growth Curve Modeling of Academic Procrastinatory Behavior, Predicted by Motivational Regulation (Study 2).

Parameter	Model 1	Model 2	Model 3
Fixed Effects			
Person level			
Intercept			
MR: Trait strategy use		-0.04 (0.05)	
MR: Trait strategy fit			-0.13** (0.05)
Slope			
MR: Trait strategy use		0.01 (0.02)	
MR: Trait strategy fit			0.03 (0.02)
Situational level			
MR: State strategy use		-0.01 (0.04)	
MR: State strategy fit			-0.41*** (0.05)
Time in days	0.01 (0.03)	0.01 (0.03)	0.01 (0.02)
Random parameters			
Person level			
$Var(r_{0i})$	0.35*** (0.04)	0.35*** (0.04)	0.33*** (0.04)
$Var(r_{1i})$	0.04*** (0.02)	0.04*** (0.02)	0.03** (0.01)
Situational level			
$Var(e_{ij})$	0.60*** (0.03)	0.60*** (0.03)	0.51*** (0.03)

Notes. $N_{\text{Person level}} = 218$, $N_{\text{Situational level}} = 1,446$. MR = Motivational regulation. Time in weeks was centered on the middle of the diary period. Parameters can be interpreted as standardized regression weights. Standard errors are presented in parentheses. $Var(r_{0i})$ indicates the residual between-person variance of academic procrastinatory behavior; $Var(r_{1i})$ estimates the (residual) between-person variance of the slope of the linear trajectories of academic procrastinatory behavior; $Var(e_{ij})$ indicates the residual within-person variance of academic procrastinatory behavior. *** $p < .001$, ** $p < .01$.

statistically significant effect on academic procrastinatory behavior. Trait strategy use positively predicted state strategy use to a small degree ($\beta = 0.13$; $p < .001$). This result differs to findings of Study 1 and is not in line with our second hypothesis, as a large habituated use of motivational regulation strategies does not seem to be associated with academic procrastinatory behavior during a common learning situation.

Subsequently, we examined the influence of motivational regulation strategy fit on academic procrastinatory behavior (see Table 4, Model 3). Trait strategy fit negatively predicted the level of academic procrastinatory behavior to a moderate degree. Unlike Study 1, there was no statistically significant effect of trait strategy fit on the trajectories of academic procrastinatory behavior. However, trait strategy fit positively predicted state strategy fit to a moderate to large degree ($\beta = 0.28$; $p < .001$). As expected, state strategy fit negatively predicted academic procrastinatory behavior to a moderate degree. Taken together, the results support our third hypothesis, as better conditional knowledge regarding the suitability of motivational regulation strategies to various motivational problems, as well as the actual fit of the chosen motivational regulation strategies to the problem at hand on a state level are associated with reduced academic procrastinatory behavior.

In the combined model (see Fig. 2), trait use of motivational regulation strategies positively predicted actual state use, and trait strategy fit predicted state strategy fit. As in Study 1, there was no statistically significant effect of trait strategy use on academic procrastinatory behavior, but trait strategy fit negatively predicted the extent of academic procrastinatory behavior (small effect). State strategy use had a small effect on academic procrastinatory behavior—which was unexpectedly, just as in Study 1, in a positive direction. State strategy fit again had a strong effect on academic procrastinatory behavior in the expected negative direction. Similar to Study 1, the results of the estimated model were robust after taking participation rate, semester, gender and study major as control variables into account³. As the results

of the main model remained the same after controlling for these variables, it seems well justified that the results are not biased by specific characteristics of the sample regarding participation rate and the demographics semester, gender and study major. Taken together, the results again partly confirm our fourth hypothesis.

In conclusion, our hypotheses were partly confirmed in Study 2. In contrast to Study 1, trait strategy use had no statistically significant effect on the academic procrastinatory behavior. Trait strategy fit as well as state strategy fit, however, had a moderate negative effect on academic procrastinatory behavior, which supports the results of Study 1 and aligns with findings of Baulke et al. (2018). In the combined model, surprisingly, state strategy use was again slightly positively associated with academic procrastinatory behavior. This result strengthens the assumption derived from Study 1 that mere strategy use might not be as helpful as fit aspects of motivational regulation for overcoming academic procrastinatory behavior.

4. General discussion

Academic procrastination can be conceptualized as an over time fluctuating and situation-specific behavior that is theoretically tied to motivational regulation. However, until now, these two phenomena have rarely been studied together, moreover little is known regarding their interrelations during specific learning processes. Applying a comprehensive view of motivational regulation, we considered motivational regulation and its linkages with procrastinatory behavior from two complementary perspectives, namely a perspective on the frequency of motivational regulation strategy use (e.g., Schwinger et al., 2009; Wolters & Benzon, 2013) and, second, a perspective on the fit of motivational regulation strategies to given, specific motivational problems (e.g., Steuer et al., 2019). On the basis of previous research by Wäschle et al. (2014) and Yerdelen et al. (2016), we assumed substantial inter-individual differences in the development of academic procrastinatory behavior over time. Additionally, we investigated how strategy use (Grunschel et al., 2016; Schwinger et al., 2009; Wolters, 2003) and strategy fit (Baulke et al., 2018) on a trait as well as on a state level (Miele & Scholer, 2017) are associated with this dysfunctional behavior. To examine the postulated paths, we conducted two longitudinal studies with university students over the course of one month in an exam preparation phase (Study 1) and during seven weeks of a semester (Study 2).

A central strength of our longitudinal studies is that they both contain many individual measurement points and capture different learning phases of university students. Using a diary method approach, state motivational regulation and state procrastinatory behaviors of the students could be recorded in a valid way (Schmitz & Wiese, 2006). Thereby, we were able to extend previous research on trait differences between the constructs by incorporating a state perspective that we innovatively also transferred to motivational regulation. This enabled us to address dynamic processes of motivational regulation as suggested by Miele and Scholer (2017) as well as Schwinger and Stiensmeier-Pelster (2012). Hence, we took a dual consideration of trait and state motivational regulation into account. However, future research should focus on cyclical, iterative processes of motivational regulation even more strongly (for instance, through conducting experience sampling studies that allow us to also address very quick passes of regulation cycles) in order to examine more subconscious regulatory processes as described by Miele and Scholer (2017) in more detail.

Furthermore, we deepened the understanding of the interrelations between the constructs, as we combined previous research by examining motivational regulation in a differentiated way, not only including the extent of motivational regulation strategy use, but also taking strategy fit into account. Additionally, we conducted analyses in parallel for both studies, facilitating a comparison and integration of the findings. Both studies focused on academic procrastinatory behavior in regard to a specific task (studying for an exam vs. studying for weekly assignments

³ Again, we additionally tested possible interaction effects of motivational regulation and students' major (primary vs. secondary teacher education studies). Similarly, no significant interaction effect on procrastinatory behavior resulted.

of a course), thereby considering two common situations during studying: The exam preparation phase and studying in general. Despite the different perspectives, samples and temporal designs of the studies, our findings consistently documented that academic procrastinatory behavior fluctuated in both studies highly intra-individually. Furthermore, ICCs of motivational regulation state strategy use and state strategy fit emphasized a time and situation specificity of motivational regulation as well. Hence, not only trait, but also state aspects of motivational regulation might have a partial explanatory value, which corresponds to the conceptualization of motivational regulation as a situation-specific process (Miele & Scholer, 2017; Schwinger & Stiensmeier-Pelster, 2012). In line with Wäschle et al. (2014) and Yerdelen et al. (2016), we found inter-individual differences between students in the development of academic procrastinatory behavior over time. Additionally, academic procrastinatory behavior decreased until the day of the first exam, which is in agreement with previous research (e.g., Wäschle et al., 2014; Wieland et al., 2018). Unlike the findings of Yerdelen et al. (2016), we did not find a significant overall linear trend in academic procrastinatory behavior during seven weeks of the semester. To examine weekly trends in more detail, future research should also include, for instance, the first weeks of the semester, as during this time students have to adapt to the new learning environment and hence might differ in their overall weekly academic procrastinatory behavior over time. Another approach to explain the effect of slope variance would be taking further individual factors as possible moderators into account, such as subjective relevance of the exam or the learning task. For instance, an exam might be perceived in general as more important than completing a weekly assignment, and that might be reflected in the academic procrastinatory behavior. Students might procrastinate less when studying for an exam in comparison to a weekly assignment, especially when the exam is close (O'Brien, 2002; Wieland et al., 2018).

Surprisingly, strategy use had, in both studies, hardly any beneficial effect on academic procrastinatory behavior. Fit aspects of motivational regulation, however, showed a negative effect on academic procrastinatory behavior and were associated with a more favorable development of this behavior over time. These findings extend research on motivational regulation and procrastination (e.g., Grunschel et al., 2016; Wolters 1999; Wolters & Benzon, 2013) as they highlight the importance of taking several aspects of motivational regulation—strategy use as well as strategy fit—into account when examining academic procrastination over time. Analyzing both motivational regulation aspects in a combined model elucidated this finding even more, as state strategy use seemed to even increase academic procrastinatory behavior after controlling for its fit aspects. On the one hand, this result could be due to negative suppression (Lubin, 1957). This occurs when adding the suppressor variable into the model causes the sign of the previous variable to be reversed. On the other hand, this result might indicate that when not using appropriate motivational regulation strategies for the specific situation, mere strategy use is rather harmful and can increase procrastinatory behavior. Specifically, for the strategy of performance-avoidance self-talk, prior research by Grunschel et al. (2016), and Schwinger and Stiensmeier-Pelster (2012) already indicated that this strategy use can also be dysfunctional and positively associated with procrastination. In the face of our findings, it seems that certain strategies are not per se adaptive or maladaptive, instead, their usefulness also depends on the situation—for instance, dependent on the question of whether the motivational critical situation involves a value or expectancy problem (Steuer et al., 2019). Hence, the nature of the motivational problem should be taken into account for selecting adequate motivational regulation strategies (see Schwinger & Stiensmeier-Pelster, 2012), as otherwise it might increase self-regulatory failure (Scholer, Miele, Murayama, & Fujita, 2018).

Taken together, the current research elucidates the relevance of motivational regulation for overcoming academic procrastinatory behavior. In particular, the fit of motivational regulation strategies seems to be beneficial for reducing this dysfunctional behavior.

Motivationally critical situations differing in regard to their motivational problem and course of action (Engelschalk et al., 2016) implies the situation-specific effectiveness of motivational regulation strategies (Pintrich, 2000; Steuer et al., 2019; Wolters & Rosenthal, 2000). To take this specificity into account, considering motivational regulation on a state level—besides the frequently applied trait perspective, especially on regulation habits—is imperative (see Miele & Scholer, 2017). Our findings indicate that state motivational regulation is of particular relevance for academic procrastinatory behavior. Through the application of state measures in addition to trait measures, not only conditional knowledge regarding the suitability of motivational regulation strategies to various motivational problems, but also the actual fit of the chosen regulation strategies to the problem at hand should be examined more profoundly in future research, as state aspects of motivational regulation seem to be of great relevance to understand learning behaviors. Therefore, a differentiation on a theoretical as well as on an empirical level between these two aspects seems to be necessary to gain the understanding of the connection between motivational regulation and academic procrastination. This could also be a promising starting point for deriving interventions on academic procrastinatory behavior: Supporting students' motivational regulation in a comprehensive way that focuses on both strategy use and strategy fit may have beneficial effects on learning behavior and may also improve academic outcomes. As the findings especially emphasize the importance of motivational regulation strategy fit, it appears promising to develop students' conditional knowledge regarding the implementation and suitability of motivational regulation strategies in specific motivational problem situations.

5. Limitations

There are four main limitations of our studies. First, we used self-report measures for academic procrastinatory behavior. Adding data from different sources would be valuable to detect academic procrastinatory behavior more objectively. Nevertheless, whether a delay is irrational must be answered by the person, as objective and subjective measures of procrastination seem to measure different things as they correlate only moderately (see Krause & Freund, 2016). Second, End-of-Day diaries can always function as an intervention, and we did not control for this effect. It might be possible that academic procrastinatory behavior decreases over time due to the diary method, which overestimates the decrease in procrastinatory behavior. Hence, the diary design (daily vs. weekly assessments) could explain differences between the two conducted studies in the trajectories of academic procrastinatory behavior. However, this method provided us with insights into specific learning behaviors in a valid and ecological way (Schmitz & Wiese, 2006). Third, we did not account for possible major-specific functionalities of motivational regulation strategies, as there is little theoretical and empirical knowledge on this topic. However, we did control for study major in the analyses and our results remained similar, which underpins the robustness of the results regardless of study major. Finally, causal conclusions cannot strictly be derived from this research, especially not from the effects on mean academic procrastinatory behavior. To test causality, future research should therefore focus on experimental designs with varying conditions.

6. Conclusion

Consistently across two different studies, our results document that academic procrastinatory behavior includes temporal and situation-specific variability, and should therefore be considered not only from a trait, but also from a state perspective. Furthermore, motivational regulation research should focus on, besides the extent of motivational regulation strategy use, fit aspects of motivational regulation strategies in connection with academic procrastinatory behavior. Our findings indicate that the mere use of motivational regulation strategies is only

slightly related to academic procrastinatory behavior, while the fit of these strategies may be particularly relevant to successfully reduce academic procrastinatory behavior. On a practical level, our findings imply that interventions on academic procrastinatory behavior might profit from including information about possibilities for motivational regulation and impart knowledge about the suitability of motivational regulation strategies in order to overcome this dysfunctional behavior.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary material

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.cedpsych.2021.101951>.

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