



Vicious and virtuous relationships between procrastination and emotions: an investigation of the reciprocal relationship between academic procrastination and learning-related anxiety and hope

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Abstract

Although cross-sectional studies depict (negative) emotions as both antecedents and consequences of trait procrastination, longitudinal studies examining reciprocal relationships between procrastination and emotions are scant. Yet, investigating reciprocal relationships between procrastination and emotions within long-term frameworks can shed light on the mechanisms underlying these relationships. Additionally, the role of positive emotions concerning procrastination is largely unattended to in the procrastination–emotion research; albeit, this perspective can inform preventive and intervention measures against procrastination. In the present study, we explored reciprocal associations between trait academic procrastination on the one hand and trait-like learning-related anxiety and hope on the other hand over one semester. Overall, $N=789$ students in German universities participated in a three-wave online panel study. Participants responded to questions on academic procrastination as well as learning-related anxiety and hope at the beginning (T1), middle (T2), and end (T3) of the lecture period of the semester in approximately 6-week measurement intervals. A latent cross-lagged panel model was used to test the hypotheses. After accounting for autoregressive effects, our results showed that academic procrastination at T1 positively predicted learning-related anxiety at T2. In contrast, academic procrastination at T1 negatively predicted learning-related hope at T2, which in turn negatively predicted academic procrastination at T3. Our results highlight positive emotions (e.g., hope) as also significant factors for procrastination and suggest them as possible “protective factors” against procrastination. Boosting positive emotions as part of interventions against procrastination could potentially help reduce the tendency to procrastinate.

Keywords Academic procrastination · Learning-related emotions · Anxiety · Hope · Longitudinal study · Latent cross-lagged panel model

Procrastination is ubiquitous in the academic context as many university students report procrastinating diverse study-related tasks (Klingsieck, 2013). For some students, this behavior is rather pervasive and trait-like, i.e., strong tendency to procrastinate regardless of academic context and situations (Steel, 2007; van Eerde, 2003). Yet, frequently engaging in academic procrastination is not only associated with negative consequences such as poor academic performance (Kim & Seo, 2015) but also with the experience of negative emotions (Behnagh & Ferrari, 2022).

Research points emotions as an important correlate of the prevalent and potentially harmful behavior of procrastination (Pychyl & Sirois, 2016). Specifically, studies have shown both state-like (i.e., unstable and situation-specific emotional experiences) and trait-like (i.e., relatively stable emotional experiences; Edmondson, et al., 2013) emotions to be correlated with trait procrastination (see overview in Behnagh & Ferrari, 2022). However, the nature of the association between emotions and procrastination remains inconclusive. Until now, studies have shown negative emotions (e.g., anxiety) as both antecedents and consequences of procrastination (Pychyl & Sirois, 2016). Yet, very little research is done to explore possible reciprocal relationships; albeit, this approach can shed light on the mechanisms underlying such relationships. The few existing studies (e.g., Gort et al., 2021; Pollack & Herres, 2020) investigating reciprocal relationships have mostly focused on the state and short-term perspective which seem to be unsuitable for capturing reciprocal effects which may be apparent in rather trait and long-term perspective.

Additionally, the existing research on procrastination is dominated by procrastination's links with negative emotions (e.g., anxiety), whereas its links with positive emotions (e.g., hope) are largely understudied (Gadosey et al., 2021). Until now, a quest for a reciprocal relationship between procrastination tendencies and discrete positive emotions is largely absent although correlations between positive emotions (e.g., hope) and procrastination have been documented (e.g., Alexander & Onwuegbuzie, 2007; Zhou & Kam, 2016). A focus on positive emotions can however shed interesting insights into a possible protective role of positive emotions concerning procrastination and contribute to a better understanding of the mechanisms that underlie the important but complex relationship between procrastination and emotions at large.

In the present study, we investigated whether there are reciprocal relationships between students' academic trait procrastination and two trait-like learning-related emotions (i.e., anxiety and hope) in a three-wave panel study over the course of one semester. Firstly, we focused on learning-related emotions as these emotions accompany students' learning in various study-related tasks and situations throughout the semester, thereby possessing trait-like character (cf. Pekrun et al., 2011). Secondly, we focused on anxiety and hope because they are the two most frequently experienced achievement emotions which can co-occur (Gadosey et al., 2021; Larsen & McGraw, 2014) and play key roles for students in both learning and examination situations (Pekrun et al., 2004; Rottweiler et al., 2018). Thirdly, we included both negative (anxiety) and positive (hope) achievement emotions to provide a broader view of the role that emotions in general and positive emotions in particular play concerning procrastination. Lastly, by focusing on a relatively long period (i.e., a semester) and wider measurement intervals (i.e., five to six weeks), we attempted to capture possible long-term effects existing between academic procrastination and learning-related emotions at the trait level.

In sum, the present study deepens the understanding of the understudied but theoretically conceivable reciprocal relationship between academic procrastination and prominent achievement emotions. By shedding light on these reciprocal relationships, we also deliver

implications for counseling services, prevention, and intervention programs that aim to reduce procrastination and improve emotional well-being of students.

Academic procrastination and emotions

Procrastination is defined as “the voluntary, irrational postponement of an intended course of action despite the knowledge that this delay will come at a cost to or have negative effects on the individual” (Simpson & Pychyl, 2009, p. 906). This behavior occurs frequently in the academic context whereby students are confronted with multiple opportunities to act and reach set goals (Hofer et al., 2017). Instead of reading, writing homework or term papers, or studying for exams, students often report engaging in “more interesting or pleasant” activities such as watching television, sleeping, playing games, or chatting with friends and family (Grund et al., 2012; Pychyl et al., 2000). In the end, the latter activities interfere with the academic tasks needed to be done and set academic goals are usually not fulfilled. Whereas procrastinatory behavior may occur occasionally and in specific situations, for some individuals, engaging in procrastinatory behavior seems to be habitual and trait-like cutting across contexts and situations (Ferrari & Tibbett, 2017). Yet, research has shown that the tendency to procrastinate (i.e., trait procrastination) is associated with several negative consequences such as deficiencies in academic performance (e.g., Kim & Seo, 2015) and heightened stress levels, as well as decreased overall life satisfaction and well-being (e.g., Beutel et al., 2016; Grunschel et al., 2013a). The high prevalence of academic procrastination coupled with the associated negative consequences makes it relevant to understand the mechanisms of procrastination.

A key factor identified to play an important role concerning students' procrastination tendencies are emotions (Pychyl & Sirois, 2016; Steel, 2007). The recent review by Behnagh and Ferrari's (2022) on affective correlates of procrastination points out empirical studies that show positive correlations between negative emotions (e.g., anxiety, boredom, frustration, and anger) and procrastination at the trait or dispositional level. Until now, research has often depicted (negative) emotions as both antecedents and outcomes of procrastination (Behnagh & Ferrari, 2022; Pychyl & Sirois, 2016). On the one hand, individuals prone to negative emotions are believed to procrastinate often as a means to escape from or deal with these bad mood and negative emotions (e.g., anxiety, frustration, boredom) they often experience (*misregulation of negative emotions*) (Pychyl & Sirois, 2016; Tice, et al., 2001). On the other hand, procrastinators (i.e., persons with higher tendencies to procrastinate) tend to report more stress (Kaftan & Freund, 2019) and negative emotions such as guilt, shame, regret, self-blame, anxiety, depression, and despair (Beutel et al., 2016; Blunt & Pychyl, 2005; Flett et al., 2016; Grunschel et al., 2013a; van Eerde, 2003). Thus, although procrastinators may tend to pursue short-term momentary relief from negative emotions, they tend to experience increased negative emotions in the long-run (Pychyl & Sirois, 2016; Steel, 2007).

Although these findings point to a potential reciprocal relationship between procrastination and negative emotions over time, only a few studies mostly from the state perspective have attempted to explore this important perspective. For instance, Pollack and Herres' (2020) 10-day daily diary study showed negative affect to precede increases in procrastination in the next day but no reciprocal relationship between procrastination on one hand and negative and positive affect on the other hand. Similarly, Gort and colleagues' (2021) 1-week ambulatory assessment study (with 10 queries per day) found positive relationship

between state procrastination and negative affect but not the expected reciprocal relationship. Subsequently, both studies reasoned that the non-significant results could be due to the short time intervals between the measurement points (i.e., a few hours to a day) because the negative emotional consequences of procrastination may not appear immediately but could take longer than hours or a single day for changes in affect to occur following procrastination and vice versa (Gort et al., 2021; Pollack & Herres, 2020). Therefore, a focus on the trait-like perspective over a relatively longer time frame and including longer measurement intervals (e.g., weeks) may be suitable to capture a possible reciprocal relationship between procrastination and emotions.

Furthermore, in the discussion on the relationship between procrastination and emotions, the emphasis has been on negative emotions, whereas the perspective of positive emotions is largely unattended. Yet, the *broaden and build theory* of positive emotions (Fredrickson, 2004) suggests that positive affect and emotions (e.g., joy, interest, and hope) facilitate learning and promote engagement and persistence on tasks. Consequently, positive emotions can help reduce the urge to procrastinate (Fredrickson, 2004; see also Tice et al., 2004). Even though few studies have documented negative correlations between positive emotions (e.g., hope) and trait procrastination (e.g., Gadosey et al., 2021; Zhou & Kam, 2016), the nature and direction of the relationship between positive emotions and procrastination remain unclear. For instance, does procrastination tendencies make individuals experience less positive emotions over time or do experiencing positive emotions make people tend to procrastinate less over time? Delving into possible reciprocal relationships between procrastination and positive emotions over time is vital if a holistic understanding of the interesting but complex mechanisms underlying the procrastination–emotion relationship is to be realized.

To address the outstanding question of potential reciprocal relationships between academic procrastination and emotions at the trait level, we focused on two of the most frequently experienced emotions (i.e., anxiety and hope) which accompany students in various learning situations throughout the semester and thereby bear a trait-like character (see Pekrun, 2006; Pekrun et al., 2011). By including two opposite learning-related emotions (i.e., anxiety and hope) which can co-occur in learning situations (Gadosey et al., 2021; Larsen & McGraw, 2014), we could shed simultaneous insights into the role that both negative and positive emotions play concerning procrastination tendencies over a relatively long period of one semester.

Learning-related anxiety and procrastination

According to Pekrun's (2006) control-value theory (CVT) of achievement emotions, anxiety is a negative emotion which characterizes an expectation of failure due to appraisals of medium to low level of control and high negative personal value of an outcome (e.g., failure). In learning context, anxiety is known to be associated with mostly negative effects such as low motivation (Pekrun et al., 2004), low self-regulation of learning (e.g., Goetz & Hall, 2013; Pekrun et al., 2002), and low subjective well-being (Steinmayr et al., 2016), as well as poor academic performance (e.g., von der Embse et al., 2018) and increased dropout intentions (e.g., Respondek et al., 2017). As a factor that challenges self-regulated learning, anxiety in general has also received the most research attention concerning procrastination (Behnagh & Ferrari, 2022). Cross-sectional studies done so far show an overall consensus of a positive relationship between anxiety and procrastination at both state and

trait levels (see review, Behnagh & Ferrari, 2022). Yet, over the course of one semester, Yerdelen et al. (2016) found negative relationship between anxiety and procrastination suggesting that anxiety's relationship with procrastination is rather complex.

Until now, the existing correlational findings depict trait anxiety as both antecedent and consequence of trait procrastination (see the overview of studies by Behnagh & Ferrari, 2022). Whereas anxious individuals are predisposed to procrastination, procrastinators are also predisposed to experiencing anxiety. Although this suggests an existing feedback loop between anxiety and procrastination, little is done so far to explore possible reciprocal relationship between these variables. Indeed, a reciprocal relationship between anxiety and procrastination is theoretically conceivable in the *behavioral model of procrastination* (Höcker et al., 2013), which depicts the negative long-term consequences of procrastination (including negative emotions such as anxiety) as feeding back into the causes of procrastination. Similarly, Wäschle et al.'s (2014) *model of virtuous and vicious circles of self-regulated learning* assumes a negative (vicious) feedback circle in which factors such as low goal achievement and low self-efficacy expectations fuel the tendency for individuals to anticipate failure (i.e., anxiety) in tasks and engage in procrastination. However, the procrastinatory behavior subsequently feeds back into more stress, negative emotions (e.g., anxiety), and feelings of low self-efficacy expectations leading to continuous avoidance of future tasks (i.e., procrastination).

To the best of our knowledge, only two studies have explored reciprocal relationships between procrastination and anxiety. Wang (2021) explored the reciprocal relationship between trait academic procrastination and trait test anxiety among high school students. In a two-wave measurement, it was found that, beyond significant autocorrelations, trait academic procrastination positively predicted trait test anxiety (but not the other way around). The scope of Wang's study is however limited given that more than two-wave measurements are recommended to provide comprehensive results when examining reciprocal relationships with the cross-lagged panel approach (Willet et al., 1998). Furthermore, Rahimi et al.'s (2023) three-wave longitudinal study over the course of one semester among graduate samples found reciprocal effects with procrastination at time 1 predicting learning-related anxiety at time 2 and learning-related anxiety at time 2 subsequently predicting procrastination at time 3. Though insightful, Rahimi et al. (2023) admitted that their use of a state measure (i.e., students reported procrastination in the last 1 week through the Academic Procrastination State Inventory (APSI; Schouwenburg, 1992)) to assess the targeted trait academic procrastination questions the match between trait procrastination and trait-like learning-related emotions in their study. Accordingly, there is still a need for further studies with at least three measurement waves to carefully examine possible reciprocal relationships between trait academic procrastination and trait-like learning-related anxiety over time.

Learning-related hope and procrastination

Based on Pekrun's CVT of achievement emotions, learning-related hope is a positive emotion which characterizes an expectation of success due to appraisals of medium to high level of control and high positive personal value of an outcome (e.g., success) (Pekrun, 2006). Consistent with hope theory (Snyder, 1995), being hopeful in relation to learning could be fairly stable and considered trait-like over time (cf. Pekrun et al., 2011). Until now, being hopeful in academic context is associated with positive effects such as increased

motivation, effort, engagement, self-regulation of learning, and positive academic performance (e.g., Dixson, 2019; Dixson et al., 2017; Pekrun et al., 2004). Yet, research on hope and procrastination tendencies is still nascent. The few existing studies are mostly cross-sectional in nature and have documented a negative relationship at the trait level between hope and procrastination (e.g., Alexander & Onwuegbuzie, 2007; Kandemir, 2014; Zhou & Kam, 2016). These findings are consistent with the *broaden and build theory of positive emotions* (Fredrickson, 2004) and Snyder's *hope theory* (Snyder, 1995) which suggests that hopeful individuals tend to engage and persist on tasks rather than avoid tasks (i.e., procrastination).

Even though the existing studies are informative, they do not explain further the nature and direction of the relationship between hope and procrastination over time. For instance, does being hopeful tend to make individuals procrastinate less or more over time and vice versa? Is there a reciprocal relationship between being hopeful and one's tendency to procrastinate over time? Studies suggest that accomplishing set goals in a timely manner grows positive emotions (e.g., Hagenauer & Hascher, 2014; Lavy & Littman-Ovadia, 2017) which in turn enhance individuals' optimism about themselves and their academic capabilities (Wäschle et al., 2014). Thus, contrary to a vicious circle, Wäschle et al. (2014) assume a *virtuous circle*, in which a positive feedback loop, for example, with engagement (as opposed to procrastination), perception of high achievement, and positive emotions exists. Despite this theoretical underpinning, little or no studies have been conducted in this direction, although delving into reciprocal relationships could reveal a possible "protective role" of hope in particular and positive emotions in general concerning procrastination. So far, only Rahimi and colleagues (2023) have documented hope predicting procrastination in their exploration of reciprocal relationships between procrastination and learning-related hope. However, as mentioned before, this study actually linked state procrastination (instead of the targeted trait procrastination) to trait-like learning emotions. In sum, there is the still need for more longitudinal studies with robust samples to shed light on possible reciprocal relationships between trait academic procrastination and trait-like learning-related hope over time.

The current study

Although empirical studies suggest that emotions can both be antecedents and consequences of procrastination (Pychyl & Sirois, 2016), there is a lack of studies exploring possible reciprocal relationships between specific emotions and procrastination in academic contexts, particularly in the long-run. The few studies which have attempted to examine reciprocal relations between emotions and procrastination have used seemingly restrictive time frames (i.e., short time frames) with a focus on state perspectives (Gort et al., 2021; Pollack & Herres, 2020) or insufficient numbers of measurement points to detect comprehensive relations (e.g., Wang, 2021). Additionally, existing studies have often focused on negative emotions, whereas little has been done regarding the role of positive emotions concerning procrastination. Taken together, there is a paucity of research investigating reciprocal relationships between procrastination and emotions (both negative and positive emotions) over a longer period of time although such investigations can deepen the understanding of underlying mechanisms of these relationships and offer starting points for prevention and interventions against procrastination.

The present study extends existing research by examining reciprocal relationships between trait academic procrastination and trait-like emotions over the course of one semester. We focused on two of the most frequently experienced learning-related emotions (anxiety and hope; Pekrun et al., 2011) to shed light on the role of both negative and positive emotions regarding procrastination. To address methodological challenges in the existing studies, we utilized a longitudinal approach with three measurement points (about five to six weeks between measurement points) over a semester. We deemed these relatively long measurement intervals to be suitable to capture emotional experiences that may develop before or after frequent procrastinatory behavior over time (Gort et al., 2021; Pollack & Herres, 2020).

Specifically, we investigated two research questions. First, we examined whether a reciprocal relationship exist between trait academic procrastination and learning-related anxiety, a negative emotion. Second, we investigated whether trait academic procrastination and learning-related hope, a positive emotion, have a reciprocal relationship. Based on the *behavioral model of procrastination* (Höcker et al., 2013), the idea of a *vicious circle of self-regulation* (Wäschle et al., 2014), and empirical studies that have shown significant positive relationships between anxiety and trait procrastination (e.g., Steel, 2007; Wang, 2021), we expected positive reciprocal effects between learning-related anxiety and academic procrastination (H1). In contrast, we expected negative reciprocal effects between learning-related hope and procrastination (H2) consistent with the virtuous circle of self-regulated learning (Wäschle et al., 2014) and empirical studies pointing to a negative relationship between hope and procrastination (e.g., Alexander & Onwuegbuzie, 2007; Zhou & Kam, 2016).

Method

Procedure and participants

This study took place in Germany during the lecture period of the 2020/2021 fall semester (second COVID-19 semester) as part of a larger research project with the superordinate goal to examine risk factors (including procrastination) for university students' dropout (Grunschel et al., 2021). Accordingly, the project targeted participants mainly in academic majors cited for high (STEM disciplines) and moderate (law, economics) dropout rates in Germany (Heublein, 2014). The larger research project spans the period of 2018–2021 with 13 measurement points. For the present study, we used relevant data of measurement points T7 (end of October/beginning of November 2020), T8 (middle of December 2020), and T9 (beginning of February 2021) in which our variables were assessed. For easy understanding, we designate T7, T8, and T9 to equal T1, T2, and T3, respectively.

We collected data mainly from three federal German universities to which the researchers of the larger project were affiliated and obtained ethical approval from one of the involved universities' ethics committee. Students from other German universities could also participate in the study. We invited the participants to the online study via emails and informed them about the purpose of the study and data privacy issues before they participated. On average, participants took $M=66.52$ ($SD=337.37$) minutes to answer the questionnaire at T1 (this questionnaire was longer than those of the remaining measurement points), $M=33.39$ ($SD=82.84$) at T2, and $M=31.98$ ($SD=61.70$) at T3. The high standard deviations are due to participants starting the survey online and then taking breaks in

between the procedure. Given that the study focused on trait-like variables, the differences in time taken to respond were not supposed to impact the study.

For the purpose of our study, we excluded students who either did not enroll for the fall semester or participants who did not give consent for data processing. At T1, $N=789$ (586 women; 200 men; 2 diverse, 1 unspecified) students studying mainly economics (22.6%), law (19.4%), teaching (22.2%), social sciences (12.7%), natural sciences (9.1%), engineering (3.8%), medicine (2.2%), humanities (1.6%), and others (6.4%). On average, they were 23.06 ($SD=3.50$) years old and had studied for 4.88 ($SD=2.29$) semesters in their major. At T2, $N=654$ students, and at T3, $N=637$ students participated. The dropout rate between T1 and T3 was 19.2% and thus in a satisfactory range (Deng et al., 2013). Participants received up to 20 euros for their participation from T1 to T3, depending on their individual compliance rate.

Measures

The overall research project collected data on different variables such as motivational, personal, and well-being factors regarding student dropout intentions. We report only the variables that are relevant to the research questions addressed in the present study.

Academic procrastination We assessed trait academic procrastination with the German version of the Tuckman Procrastination Scale (*TPS-d*; Stöber & Joormann, 2001; Tuckman, 1991), adapted to the academic context (Grunschel et al., 2013b). The *TPS-d* consists of 16 items describing students' delay of study-related tasks (e.g., "I needlessly delay the completion of work in my studies, even if they are important"). Responses ranged from 1 (*this is not at all true*) to 5 (*this is very true*). The reliability was very good at all three measurement points ($\omega_{T1} = .95$, $\omega_{T2} = .96$, $\omega_{T3} = .96$).

Learning-related emotions We assessed both trait-like learning-related anxiety and hope with three items each from the Achievement Emotion Questionnaire (AEQ; Pekrun et al., 2002, 2011). In the present study, we focused on items describing the emotions (i.e., anxiety and hope) typically experienced by students while studying in order to capture these emotions in relation to the overall learning activities. Each item was rated on a five-point Likert scale (1 = *is not true at all* to 5 = *is perfectly true*). A sample item for learning-related anxiety was "I get tense and nervous while studying." Reliability for learning-related anxiety was acceptable at all three measurement points ($\omega_{T1} = .76$, $\omega_{T2} = .77$, $\omega_{T3} = .79$). Learning-related hope (e.g., "I feel confident when studying") recorded good reliability at all three measurement points ($\omega_{T1} = .81$, $\omega_{T2} = .80$, $\omega_{T3} = .85$).

Data analysis

First, we assessed panel attrition as well as descriptive statistics and bivariate correlations of all variables of interest using SPSS version 28. Specifically, we checked whether the attrition of participants was associated with procrastination, learning-related anxiety, and hope, as well as relevant demographic variables including gender, age, and semester. Significant mean differences between groups (i.e., number of measurement points completed) implied systematic missingness (Enders, 2010; see "Panel attrition analysis"). We addressed systematic missingness by using multiple imputation (MI), a technique whereby

missing data are imputed several times to generate several sets of complete-data estimates of the parameters (Newman, 2003). Parameter estimates from each imputation are then averaged to give an overall estimate of the complete-data parameters and typical standard errors (Newman, 2003). Furthermore, the imputation procedure provides the advantage of including any relevant variable (e.g., sociodemographic variables) as auxiliary variables that account for missingness and/or are correlated with the variables of interest to help estimate models as correctly as possible (Geiser, 2013). Compared to analyzing participants with complete data only, MI is more robust and reduces wastefulness of data and biased results (Asendorpf et al., 2014; Van Ginkel et al., 2020). We followed the guidelines of Geiser (2021) and employed the recommended 50 multiple imputations (Asendorpf et al., 2014) with Mplus version 8.7 (Muthén & Muthén, 1998; 2017).

To examine the reciprocal relationships between academic procrastination and learning-related anxiety and hope, we used the latent cross-lagged panel model (CLPM; Geiser, 2013) with Mplus version 8.7 (Muthén & Muthén, 1998, 2017). The CLPM is an analytical strategy that can detect directional influences or reciprocal relationships between variables over time by establishing temporal precedence (Kearney, 2017). Additionally, it ensures tests of measurement invariance and model fit while controlling for measurement error (Coffman & MacCallum, 2005; Geiser, 2013). Thus, CLPM was suitable for our research questions which sought to identify longitudinal reciprocal relationships between academic procrastination and learning-related emotions (i.e., anxiety and hope).

The latent models consist of two parts, a measurement model and a structural model (Geiser, 2013). Whereas the measurement model shows how latent variables are measured by observed variables (i.e., indicators), the structural model specifies relationships between latent variables in terms of path analyses (Geiser, 2013). As recommended by Coffman and MacCallum (2005), we used both parcels and single items as indicators for our latent variables to simplify the measurement model. Regarding procrastination which we assessed by using 16 items, we built four parcels with the item-to-construct method (see Little et al., 2002; Scheunemann et al., 2022). We matched the highest loading items with the lowest loading items and continued this process until we obtained four parcels consisting of four items each with balanced loadings. We additionally correlated the errors of the same parcels over time to account for indicator-specific effects (Geiser, 2013). Based on Kline's (2005) recommendation of at least three indicators per construct, we modeled both learning-related anxiety and hope with three items each as indicators.

Concerning the structural model of the CLPM, we specified a combined model (see Fig. 1) that displays simultaneously, the relationships between both emotions and procrastination given that anxiety and hope can co-occur in learning contexts (Gadosey et al., 2021; Larsen & McGraw, 2014). Besides, combined models (compared to single models) have an added value of being statistically parsimonious and produce estimations and predictions that are more precise as they control for the effects of as many variables as possible (Kelley & Bolin, 2013). We specified autoregressive effects (i.e., relation of the same construct between subsequent points in time) to offer information about the stability of each construct (Geiser, 2013). To improve the model fit, we included both first-order (e.g., procrastination at T1 on procrastination at T2) and second-order (e.g., procrastination at T1 on procrastination at T3) autoregressive paths. We also accounted for situation-specific effects by including within-time correlations. We therefore correlated the latent variables at T1 and the residuals of the latent variables at each of the other time points (Geiser, 2013). Finally, we included the cross-lagged paths (i.e., effects of additional, temporally preceding variables) to explain remaining variance not yet explained by the autoregressive effects (e.g., learning-related anxiety at T1 on procrastination at T2 or procrastination

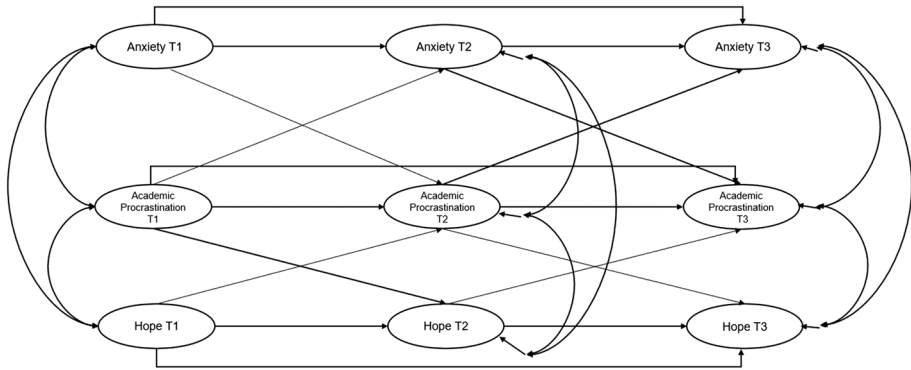


Fig. 1 A combined latent cross-lagged panel model, with three measurement points, for academic procrastination, learning-related anxiety, and learning-related hope. *Note:* T1/T2/T3 represent first/second/third measurement time point. Ellipses illustrate latent variables. Arrows indicate the direction of the relationship; double arrows indicate correlations. We refrained from presenting the measurement model in favor of clarity; error variables were auto-correlated

at T1 on learning-related anxiety at T2). To validate our model, we referred to fit indices recommended by Weston et al. (2008) including comparative fit index (CFI) ≥ 0.95 , root mean squared error of approximation (RMSEA) ≤ 0.06 , and standardized root mean residual (SRMR) ≤ 0.08 . We also examined the chi-square test of model fit (χ^2) although it is known to be sensitive to large sample sizes and hardly offers tests for exact model fit (Weston et al., 2008). We conducted all tests at alpha of 0.05, two-tailed.

Before conducting the aforementioned CLPM, we first examined measurement invariance for each variable over time. Measurement invariance across time indicates that the measures used have the same meaning and represent comparable constructs across the different measurement points (Chen, 2007; Geiser, 2013). Following Chen (2007), we tested three forms of measurement invariance. First, we tested *configural invariance* (i.e., a model without any constraints on the factor loadings and intercepts of our indicators) against *metric invariance* (i.e., a model with constrained factor loadings of the same indicators over time and no constraints on the intercepts). Afterwards, we compared *metric invariance* to *scalar invariance* (i.e., a model with both constrained factor loadings and intercepts of the same indicators over time). According to Chen (2007), the following cut-offs for differences in CFI, RMSEA, and SRMR indicate possible noninvariance: $\Delta\text{CFI} \geq -0.010$, accompanied by $\Delta\text{RMSEA} \geq 0.015$ or $\Delta\text{SRMR} \geq 0.030$ for metric invariance and $\Delta\text{CFI} \geq -0.010$, accompanied by $\Delta\text{RMSEA} \geq 0.015$ or $\Delta\text{SRMR} \geq 0.010$ for scalar invariance. Scalar invariance is recommended for conducting CLPM (Chen, 2007).

Results

Panel attrition analysis

We tested whether differences existed among participants who completed all three measurement points ($n = 605$, 76.6%), only two measurement points ($n = 83$, 10.6%), or only T1 ($n = 101$, 12.8%) in terms of academic procrastination, learning-related anxiety, learning-related hope, gender, age, and semester studied at T1. Given that our relevant

variables were not normally distributed and our comparison groups differed largely in size, the Kruskal–Wallis test was appropriate for testing the differences (Field, 2013). Regarding gender, chi-square tests were suitable because gender is categorical (Field, 2013). The analysis revealed significant differences between the three groups concerning academic procrastination, $H(2) = 31.20$, $p < 0.001$; learning-related anxiety, $H(2) = 8.93$, $p = 0.01$; learning-related hope, $H(2) = 14.36$, $p < 0.001$; and semester $H(2) = 31.20$, $p = 0.04$ (details of the significant differences between the groups can be seen in Supplementary Table 1). But there were no significant differences concerning age, $H(2) = 1.20$, $p = 0.55$, and gender, $\chi^2(2) = 3.61$, $p = 0.17$. Taken together, our data showed systematic attrition (Enders, 2010). Therefore, we implemented multiple imputation with 50 imputations to handle missing data (see Asendorpf et al., 2014).

Descriptive statistics and bivariate correlations

Table 1 exhibits the descriptive statistics and bivariate correlations between academic procrastination, learning-related anxiety, and hope from T1 to T3. There were moderate to high (significant) correlations (cf. Cohen, 1988) among procrastination, learning-related anxiety, and learning-related hope. Procrastination correlated positively with learning-related anxiety but negatively with learning-related hope. Also, learning-related anxiety and hope correlated moderately negatively. Furthermore, correlations within the same construct were higher compared to those between different constructs suggesting that each construct was relatively stable over time (Geiser, 2013). Additionally, first-order correlations of the same construct (e.g., procrastination at T1 and T2) were higher than second-order correlations (e.g., procrastination at T1 and T3) suggesting an autoregressive structure between the variables (Geiser, 2013).

There were also some significant correlations between sociodemographic variables and our variables of interest. Gender correlated weakly positive with procrastination (T1–T3) and weakly negative with learning-related anxiety (T1–T3) and hope (T2). Thus, males compared to females reported more procrastination tendencies, whereas females compared to males reported more learning-related anxiety and hope. Also, age correlated weakly negative with procrastination (T1–T3) suggesting that older students reported less procrastination than younger students. Lastly semester studied correlated weakly positive with procrastination (T1) and learning-related anxiety (T1–T3) suggesting that students in higher semesters reported higher procrastination and learning-related anxiety than lower semester students. Given these significant correlations between these key sociodemographic variables and our variables of interest, we included gender, age, and semester in the imputation procedure to control for their effects and improve the estimation of missing data (Enders, 2010; Geiser, 2013).

Tests of measurement invariance

We examined measurement invariance (i.e., configural, metric, and scalar invariance) for each variable across the three measurement points. Table 2 summarizes the test statistics concerning the three models. Based on the criteria of Chen (2007), we established scalar invariance (i.e., strong invariance) over time for all three constructs. Therefore, we used scalar invariance in specifying our latent CLPM.

Table 1 Descriptive statistics and intercorrelations of academic procrastination, learning-related anxiety, learning-related hope, and sociodemographic variables at all measurement points

Variable	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9	10	11	12
1 Procrastination T1	2.71	.90	—	.88**	.84**	.35**	.33**	.28**	-.54**	-.50**	-.39**	.10**	.07*	.13**
2 Procrastination T2	2.68	.89		—	.88**	.31**	.40**	.31**	-.49**	-.55**	-.42**	.09*	.08	.09
3 Procrastination T3	2.64	.90			—	.31**	.36**	.33**	-.50**	-.54**	-.49**	.13*	.08*	.07
4 Anxiety T1	3.45	.95				—	.69*	.64**	-.45**	-.39**	-.37**	-.14**	.06	.11**
5 Anxiety T2	3.11	.96					—	.69**	-.38**	-.40**	-.38**	-.13**	.05	.08*
6 Anxiety T3	3.22	.99						—	-.33**	-.34**	-.48**	-.19**	.05	.10*
7 Hope T1	3.45	.82							—	.65**	.56**	-.04	-.06	-.09
8 Hope T2	3.40	.78								—	.66**	-.08*	-.06	-.04
9 Hope T3	3.34	.85									—	-.01	-.03	-.06
10 Gender ^a	—	—										—	.13**	-.01
11 Age	23.06	3.50											—	.10**
12 Semester	4.88	2.29												—

$N_{T1} = 789$, $N_{T2} = 654$, $N_{T3} = 637$. T1/T2/T3, first/second/third measurement time point. ^a1 = female, 2 = male. All scales range from 1 to 5; * $p < .05$. ** $p < .01$

Table 2 Summary of test statistics for academic procrastination, learning-related anxiety, and learning-related hope concerning measurement invariance across time

Variable	Fit indices				Model comparison		
	χ^2 (df)	CFI	RMSEA	SRMR	Δ CFI	Δ RMSEA	Δ SRMR
Procrastination							
Configural invariance	58.907 (39)	.998	.023	.009			
Metric invariance	70.379 (45)	.997	.027	.015	-.001 ^a	.004 ^a	.006 ^a
Scalar invariance	102.973 (51)	.994	.036	.020	-.003 ^b	.009 ^b	.005 ^b
Anxiety							
Configural invariance	21.334 (15)	.998	.023	.016			
Metric invariance	34.004 (19)	.994	.032	.030	-.004 ^a	-.009 ^a	.014 ^a
Scalar invariance	48.456 (23)	.990	.037	.036	-.004 ^b	.005 ^b	.006 ^b
Hope							
Configural invariance	23.573 (15)	.996	.027	.017			
Metric invariance	28.944 (19)	.996	.026	.024	.000 ^a	-.001 ^a	.007 ^a
Scalar invariance	37.758 (23)	.994	.029	.029	-.002 ^b	.003 ^b	.005 ^b

CFI comparative fit index; RMSEA root mean squared error of approximation; SRMR standardized root mean square residual. ^aComparison of configural invariance model with metric invariance model. ^bComparison of metric invariance model with scalar invariance model

Table 3 Standardized autoregressive and cross-lagged effects of academic procrastination, learning-related anxiety, and learning-related hope for the cross-lagged panel model

Effect	T1 → T2			T2 → T3			T1 → T3		
	β	SE	p	β	SE	p	β	SE	p
Autoregressive effects									
Procrastination (P)	0.89	0.02	<.001	0.57	0.05	<.001	0.31	0.05	<.001
Anxiety (A)	0.76	0.03	<.001	0.51	0.08	<.001	0.32	0.07	<.001
Hope (H)	0.68	0.04	<.001	0.66	0.08	<.001	0.20	0.08	<.01
Cross-lagged effects									
P → A	0.10	0.04	.01	0.02	0.04	.69	-	-	-
A → P	0.01	0.03	.78	-0.02	0.03	.50	-	-	-
P → H	-0.17	0.05	<.001	0.07	0.05	.15	-	-	-
H → P	-0.03	0.04	.50	-0.10	0.03	.002	-	-	-

N=789 with 50 imputed data; P academic procrastination, A learning-related anxiety, and H learning-related hope. Explained variance for academic procrastination: $R^2_{T2}=82\%$, $R^2_{T3}=84\%$; learning-related anxiety: $R^2_{T2}=65\%$, $R^2_{T3}=64\%$; learning-related hope: $R^2_{T2}=64\%$, $R^2_{T3}=60\%$

Hypothesis testing with the latent cross-lagged panel model (CLPM)

To test our hypotheses 1 and 2 concerning the reciprocal relationship of procrastination and the learning-related emotions of anxiety and hope, we conducted a latent CLPM. Table 3 shows both the significant and the non-significant standardized effects

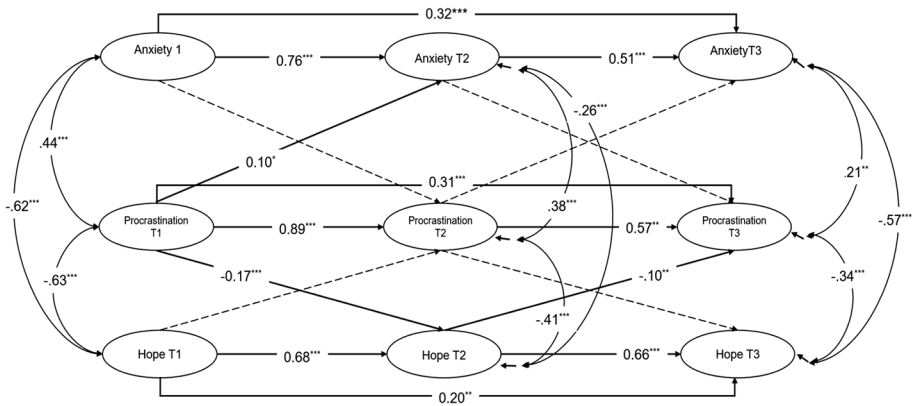


Fig. 2 Results of the latent cross-lagged panel model for academic procrastination, learning-related anxiety, and learning-related hope. *Note:* standardized coefficients path coefficients. T1/T2/T3, first/second/third measurement time point. Dotted lines indicate non-significant paths. * $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$

of the estimated combined model.¹ The chi-square test of our model was significant ($\chi^2 = 1485.73$, $df = 474$, $p < 0.001$). Nonetheless, all other fit indices indicated a good fit for our model (CFI = 0.95, RMSEA [90% CI] = 0.05 [0.05, 0.06], SRMR = 0.07) (cf. Weston et al., 2008). Figure 2 displays an overview of the significant standardized effects of our latent CLPM.

All autoregressive effects were significantly positive. In addition, first-order autoregressive effects were stronger than second-order autoregressive effects (see Fig. 2 and Table 3). Taken together, our three constructs demonstrated high temporal stability.

Additionally, we took situation-specific effects into account by correlating the latent variables at T1 and the residuals of the latent variables at each of the other time points (within-time correlations; Geiser, 2013). Overall, all within-time correlations between procrastination, learning-related anxiety, and hope were significant (see Fig. 2). All within-time correlations between procrastination and learning-related anxiety were low to moderate and positive, whereas all within-time correlations between procrastination and learning-related hope were moderate and negative. The within-time correlations between learning-related anxiety and hope were low to moderate and negative.

Finally, we tested whether learning-related anxiety, a negative emotion, and learning-related hope, a positive emotion, have reciprocal relationships with procrastination after controlling for autocorrelations. As shown in Table 3 regarding hypothesis 1, our model showed positive cross-lagged effects of academic procrastination (T1) on learning-related anxiety (T2). Furthermore, regarding hypothesis 2, academic procrastination (T1) negatively predicted hope (T2), which in turn negatively predicted procrastination (T3). No other cross-lagged paths were significant (see Fig. 2).

¹ Supplementary tables contain summaries of the single CLPMs. Supplementary Table 2 presents standardized estimates of CLPM for reciprocal relationships between learning-related anxiety and academic procrastination. Supplementary Table 3 presents the reciprocal relationships between learning-related hope and academic procrastination.

Discussion

Procrastination is prevalent in higher education, and emotions are considered to play an important role concerning students' procrastinatory tendencies. Theoretical models such as the *behavioral model of procrastination* (Höcker et al., 2013) and the *virtuous and vicious cycle of self-regulated learning* (Wäschle et al., 2014) suggest possible bidirectional relationships between procrastination and emotions over time. We aimed to shed light on the understudied reciprocal relationship between trait academic procrastination and trait-like learning-related anxiety and hope over a long period of time. Implementing a three-wave longitudinal study over the course of one semester, we employed a latent CLPM model to analyze the reciprocal relationships between procrastination and these emotions beyond the stable aspects of these constructs.

Stability and cross-sectional relationships of between procrastination, anxiety, and hope

The autoregressive analyses gave insight into the stability of our constructs over time. The autoregressive effects showed that academic procrastination, learning-related anxiety, and learning-related hope were relatively stable and trait-like constructs over the span of one semester (Cohen, 1988). Our findings are consistent with the few existing longitudinal studies which also reported substantial stability in both anxiety (e.g., Rahimi et al., 2023; Wang, 2021) and procrastination (e.g., Scheunemann et al., 2022; Wang, 2021) over a semester. In contrast, there is a paucity of longitudinal studies that show the pattern of learning-related hope over the course of a semester. Hence, our study is one of the primary studies to demonstrate that hope, as a positive learning-related emotion, is relatively stable over the course of a semester.

Our study also replicated cross-sectional results concerning concurrent bivariate relationships between our variables at each measurement point. All zero-order correlations as well as within-time correlations (derived from our latent cross-lagged model after modeling autoregressive paths) demonstrated significant and consistent relationships similar to previous cross-sectional findings. Specifically, trait academic procrastination correlated positively with learning-related anxiety (cf. Rahimi et al., 2023; Steel, 2007; Wang, 2021) but negatively with learning-related hope (cf. Alexander & Onwuegbuzie, 2007; Rahimi et al., 2023; Zhou & Kam, 2016). Furthermore, learning-related anxiety correlated negatively with learning-related hope (cf. Gadosey et al., 2021; Pekrun et al., 2004). Taken together, these concurrent relationships suggest that individuals who report high tendencies to procrastinate are also predisposed to experiencing more negative emotions (e.g., anxiety) but less positive emotions (e.g., hope).

Reciprocal relationship between procrastination and anxiety

Concerning our first research question, we expected that academic procrastination and learning-related anxiety would show positive reciprocal relationships beyond autoregressive effects (H1). Our analyses only showed that procrastination at T1 positively predicted anxiety at T2. This finding is consistent with existing studies which also found procrastination to be positively related to subsequent anxiety (Rahimi et al., 2023; Wang, 2021). We can trace this relationship in the models of Höcker et al. (2013) and Wäschle et al. (2014) and in previous studies (e.g., Beutel et al., 2016; Grunschel et al., 2013a; Wang, 2021)

which depict negative emotions such as anxiety as outcomes of procrastination. Our results support the notion that procrastination is a potentially harmful academic behavior which breeds several negative consequences including negative emotions such as anxiety (Steel, 2007). As researchers suggested, procrastination only acts as a form of short-term mood repair and brings momentary relief; but in the long-run, facing the undone task is associated with more stress and anxiety (Pychyl & Sirois, 2016; Steel, 2007).

In our study, learning-related anxiety did not significantly precede academic procrastination. Thus, our result could not support the *misregulation of emotions* hypothesis (Sirois & Pychyl, 2013) and existing studies which suggest that experiencing anxiety increases the tendency to procrastinate (Pychyl & Sirois, 2016; Steel, 2007; Tice, et al., 2001). This non-significant result may lie in the ambivalent character of anxiety. Inasmuch as the relationship between anxiety and procrastination is largely positive (see Behnagh & Ferrari, 2022), studies have also shown negative relationships between anxiety and procrastination (e.g., Yerdelen et al., 2016). Although learners may deal with anxiety by avoiding unpleasant learning situations and activities (Sirois & Pychyl, 2013), some anxious individuals may be motivated to engage more in the learning tasks (Norem, 2008; Pekrun et al., 2011). Indeed, studies have shown that some individuals may use defensive pessimism (i.e., anticipating worst possible outcomes) (see Norem, 2008; Norem & Cantor, 1986) as a strategy of converting experienced anxiety into exerting more effort and eventually achieving positive outcomes (e.g., Cantor, 1990; Norem, 2008; Suárez Riveiro, 2014). Thus, avoiding tasks (i.e., procrastination) may not necessarily be the coping strategy used by all students to downregulate anxiety at all times and in all situations. Perhaps individuals then may have some level of anxiety (a threshold) beyond which avoidance strategies or procrastination are more likely to be used to cope with learning tasks and situations. Hence, there should be more research into the question of under which conditions and situations anxiety may or may not be associated with procrastination. Focusing on the situational perspective with a moment-to-moment assessment approach over longer time periods could help address this interesting research question.

Reciprocal relationship between procrastination and hope

Regarding our second research question, we expected a negative reciprocal relationship between academic procrastination and learning-related anxiety (H2). We found that academic procrastination at T1 was negatively related to learning-related hope at T2 which in turn was negatively related to academic procrastination at T3. Our study is the first to show this interesting reciprocal effect between academic procrastination and learning-related hope. We found that over time higher tendencies to procrastinate could contribute to the experience of low levels of hope. Conversely, lower tendencies to procrastinate could lead to the experience of increasing levels of hope. Consequently, we can situate this finding in the *virtuous circle of self-regulated learning* (Wäschle et al., 2014) which suggests that engaging in tasks and completing them on time (as against procrastinating the tasks) breeds positive emotions such as hope in mastering and completing future tasks.

Furthermore, learning-related hope at T2 was found to negatively predict academic procrastination tendencies at T3 similar to the results of Rahimi and colleagues (2023). This finding can be interpreted as experiencing more learning-related hope at T2 could contribute to lower tendencies of academic procrastination at T3. This finding is in line with the *broaden and build theory* (Fredrickson, 2004) as well as Pekrun's *control-value theory* (Pekrun, 2006) which suggests that experiencing positive emotions increases motivation

and facilitates learning. Thus, experiencing positive emotions in learning situations over time could be a protective factor which hinders the tendency to procrastinate (Tice et al., 2004; Wäschle et al., 2014).

Taken together, our study is the first to provide support for a reciprocal relationship between a specific positive emotion (i.e., learning-related hope) and procrastination tendencies with relatively long measurement intervals. In this study, trait procrastination (not learning-related hope) turned out to be the starting point of the expected reciprocal relationship between procrastination and learning-related hope. This suggests that the tendency to procrastinate plays a critical role in sparking the experience of different emotions over time. Given that our study is one of first to examine these reciprocal relationships, we recommend further empirical research to explore the starting points of the reciprocal relationship between positive emotions and procrastination. Future studies can extend the longitudinal study by following participants across several semesters to increase the chances of detecting stable possible reciprocal relationships over time. Consequently, this approach would strengthen the theory of virtuous and vicious circle of self-regulated learning (Wäschle et al., 2014).

Overall, the present study underscores that positive achievement emotions (apart from negative achievement emotions) can also play critical role concerning procrastination. To contribute to the potential that positive emotions possess to deal with this dysfunctional behavior of procrastination, future studies should explore further positive emotions such as joy, pride, interest, enjoyment, contentment, and relief (Fredrickson, 2004; Pekrun, 2006) in relation to procrastination.

Practical implications

Our study supports the view that procrastination brings negative consequences such as anxiety in the learning context and hence calls for intervention. In dealing with procrastination, Eckert et al. (2016) suggest that negative emotions should be modified or positive emotions should be increased. To cut short a possible negative feedback loop (see Höcker et al., 2013; Wäschle et al., 2014), learners and specially procrastinators can be taught to cope adaptively with negative emotions. Following the *adaptive coping with emotions model* (ACE model; Berking & Whitley, 2014) and intervention studies (e.g., Eckert et al., 2016; Schuenemann et al., 2022), promoting acceptance and tolerance of negative emotions could help learners build resilience and better regulate negative emotions and improve their productivity.

Our findings concerning hope and procrastination bring to light the prospects in fostering positive emotions to deal with procrastination. Instructors could help learners re-evaluate their learning situations and tasks in a positive light to increase their sense of self-efficacy and perception of control of academic tasks (Respondek et al., 2017). Also, procrastination interventions (see the overview of procrastination interventions by van Eerde & Klingsieck, 2018) could integrate — beyond dealing with negative emotions — increasing specific positive emotions (e.g., hope, pride, enjoyment) to promote engagement in academic tasks. For example, when conducting procrastination interventions, such as cognitive behavioral approach (e.g., Ozer et al., 2013) and emotion regulation training (Eckert et al., 2016), some sessions could be dedicated to triggering positive emotions by making participants for instance reflect and relive past positive academic experiences and related positive emotions (Arditte Hall et al., 2018; Lambert et al., 2013). This would help

individuals leverage positive emotions as resources to engage more in academic tasks and situations and reduce the tendency of procrastination among learners.

Limitations and directions for future research

Our study has some limitations which offer opportunities to strengthen future research in this area. First, our study employed completely self-report data which is often criticized as prone to social desirability and response bias. Yet, given that trait procrastination as well as emotional evaluations based on perceptions of control and value related to learning activities is subjective in character, the use of self-reports seems necessary approach of assessment (cf. Spector, 2006).

Further, we are careful with the extent of generalizing our results. We had systematic missing data in our study. Although multiple imputation deals with missing data to reduce bias results, we acknowledge that this procedure does not completely eliminate bias characteristic of systematic missingness (Asendorpf et al., 2014). Furthermore, even though our study has a merit of reaching out to students from diverse universities across Germany, we are limited in controlling for university-specific effects that may impact our results. Also, our sample was clearly dominated by female students compared to male students. Future studies should consider a more equal distribution of sample characteristics such as gender to strengthen the current results.

Moreover, our study was conducted during the second COVID-19 semester in Germany in which university education was primarily realized online. Consequently, learning conditions as well as students' learning strategies and well-being, among others, may differ compared to times before the pandemic (see Gadosey et al., 2022; Hilpert et al., 2022; Sahu, 2020). Presently, we are not able to tease out directly how the pandemic might have influenced our findings. We recommend future studies to further investigate potential bidirectional relationships between specific emotions and procrastination beyond the pandemic to replicate our findings.

Lastly, the scope of our study can be extended. There remain other unexamined variables, for example, person factors such as learner's motivation, perception of competence, perceived control, value perceptions, and diagnosis of anxiety or depression, as well as contextual factors such as course content and structure that can also play roles concerning the relationship between procrastination and emotions (Klingsieck, 2013; Svartdal et al., 2020). Future studies could examine the influence of these moderators or mediators and strengthen existing models.

Conclusion

The current study offers first insights into how academic procrastination and specific negative (e.g., anxiety) and positive (e.g., hope) learning-related achievement emotions relate reciprocally over the course of one semester. Overall, the results regarding reciprocal relationships between learning-related hope and academic procrastination highlight the important role that positive emotions play concerning academic procrastination. This study points out that positive emotions such as hope could serve as "protective factors" to help reduce the tendency to procrastinate. In conclusion, we recommend intensive research into investigating reciprocal relationships for specific positive and negative emotions with regard to procrastination.

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Data availability The data on which our analyses are based can be provided on request.

Declarations

Conflict of interest The authors declare no competing interests.

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The authors' current themes of research and relevant publications in the field of psychology of education
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Current themes of research:

Academic procrastination

Epistemic emotions and emotion regulation

Academic success

Most relevant publications in the field of Psychology of Education:

Gadosey, C.K., Grunschel, C., Kegel, L. S., Schnettler, T., Turhan, D., Scheunemann, A., Bäumle, L., Thomas, L., Buhlmann, U., Dresel, M., Fries, S., Leutner, D. & Wirth, J. (2022). Study satisfaction among university students during the COVID-19 pandemic: Longitudinal development and personal-contextual predictors. *Frontiers in Psychology, 13*:918367. <https://doi.org/10.3389/fpsyg.2022.918367>

Turhan, D., Schnettler, T., Scheunemann, A., Gadosey, C. K., Kegel, L. S., Bäumle, L., Thies, D. O., Thomas, L., Buhlmann, U., Dresel, M., Fries, S., Leutner, D., Wirth, J., & Grunschel, C. (2022). University Students' Profiles of Burnout Symptoms amid the COVID-19 Pandemic in Germany and their Relation to Concurrent Study Behavior and Experiences. *International Journal of Educational Research, 116*(5), <https://doi.org/10.1016/j.ijer.2022.102081>

Gadosey, C. K., Schnettler, T., Scheunemann, A., Fries, S., & Grunschel, C. (2021). The intraindividual co-occurrence of anxiety and hope in procrastination episodes during exam preparations: An experience sampling study. *Learning and Individual Differences, 88*(7), <https://doi.org/10.1016/j.lindif.2021.102013>

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Current themes of research:

Student success and student dropout intention

Student's academic motivation (situated expectancy-value theory)

Academic procrastination

Ambulatory assessment

Most relevant publications in the field of Psychology of Education:

Scheunemann, A., Schnettler, T., Bobe, J., Fries, S., & Grunschel, C. (2021). A longitudinal analysis of the reciprocal relationship between academic procrastination, study satisfaction, and dropout intentions in higher education. *European Journal of Psychology of Education*, . <https://doi.org/10.1007/s10212-021-00571-z>

Schnettler, T., Bobe, J., Scheunemann, A., Fries, S., & Grunschel, C. (2020). Is it still worth it? Applying expectancy-value theory to investigate the intraindividual motivational process of forming intentions to drop out from university. *Motivation and Emotion*, *44*, 491–507. <https://doi.org/10.1007/s11031-020-09822-w>

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Current themes of research:

Student success and student dropout intention

Academic procrastination

Motivation

Most relevant publications in the field of Psychology of Education:

Scheunemann, A., Schnettler, T., Bobe, J., Fries, S., & Grunschel, C. (2021). A longitudinal analysis of the reciprocal relationship between academic procrastination, study satisfaction, and dropout intentions in higher education. *European Journal of Psychology of Education*, <https://doi.org/10.1007/s10212-021-00571-z>

Schnettler, T., Bobe, J., Scheunemann, A., Fries, S., & Grunschel, C. (2020). Is it still worth it? Applying expectancy-value theory to investigate the intraindividual motivational process of forming intentions to drop out from university. *Motivation and Emotion*, *44*, 491–507. <https://doi.org/10.1007/s11031-020-09822-w>

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Current themes of research:

Self-regulated learning in higher education with focus on procrastination

Motivation and motivational regulation in educational settings

Study success and study dropout

Most relevant publications in the field of Psychology of Education:

Bäumke, L., Daumiller, M., & Dresel, M. (2021). The role of state and trait motivational regulation for procrastinatory behavior in academic contexts: Insights from two diary studies. *Contemporary Educational Psychology*, *65*, 101951. <https://doi.org/10.1016/j.cedpsych.2021.101951>

Bäumke, L., Grunschel, C. & Dresel, M. (2021). Student dropout at university: A phase-orientated view on quitting studies and changing majors. *European Journal of Psychology of Education* [advance online publication]. <https://doi.org/10.1007/s10212021-00557-x>

Bäumke, L., Daumiller, M. & Dresel, M. (2019). How conscientiousness and neuroticism affect academic procrastination: Mediated by motivational regulation? *Zeitschrift für Entwicklungspsychologie und Pädagogische Psychologie*, *51*, 216–227. <https://doi.org/10.1026/0049-8637/a000225>

Bäumke, L., Eckerlein, N., & Dresel, M. (2018). Interrelations between motivational regulation, procrastination and college dropout intentions. *Unterrichtswissenschaft*, *46*(4), 461–479. <https://doi.org/10.1007/s42010-018-0029-5>

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Current themes of research:

Currently practicing psychologist and sports therapist

Most relevant publications in the field of Psychology of Education:

Turhan, D., Schnettler, T., Scheunemann, A., Gadosey, C. K., Kegel, L. S., Bäumke, L., Thies, D. O., Thomas, L., Buhlmann, U., Dresel, M., Fries, S., Leutner, D., Wirth, J., & Grunschel, C. (2022).

University Students' Profiles of Burnout Symptoms amid the COVID-19 Pandemic in Germany and their Relation to Concurrent Study Behavior and Experiences. *International Journal of Educational Research*, *116*(5), <https://doi.org/10.1016/j.ijer.2022.102081>

Kegel, L. S., Schnettler, T., Scheunemann, A., Bäumke, L., Thies, D. O., Dresel, M., ... & Grunschel,

C. (2021). Unterschiedlich motiviert für das Studium: Motivationale Profile von Studierenden und ihre Zusammenhänge mit demografischen Merkmalen, Lernverhalten und Befinden [Different motivational profiles of university students and their relation to demographic characteristics, learning behavior, and study-related well-being]. *Zeitschrift für empirische Hochschulforschung*, 4(1), 81–105. <https://doi.org/10.3224/zehf.v4i1.06>

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Current themes of research:

Self-regulated learning

Motivation and motivational regulation

Achievement goal orientations

Student dropout

Most relevant publications in the field of Psychology of Education:

Bieg, S., Grassinger, R. & Dresel, M. (2019). Teacher humor: Longitudinal effects on students' emotions. *European Journal of Psychology of Education*, 34, 517–534. <https://doi.org/10.1007/s10212-018-0402-0>

Daumiller, M., Dickhäuser, O., & Dresel, M. (2019). University instructors' achievement goals for teaching. *Journal of Educational Psychology*, 111, 131–148. <https://doi.org/10.1037/edu0000271>

Dresel, M., Schmitz, B., Schober, B., Spiel, S., Ziegler, A., Engelschalk, T., Jöstl, G., Klug, J., Roth, A., Wimmer, B., & Steuer, G. (2015). Competencies for successful self-regulated learning in higher education: Structural model and indications drawn from expert interviews. *Studies in Higher Education*, 40, 454–470. <https://doi.org/10.1080/03075079.2015.1004236>

Händel, M., Harder, B. & Dresel, M. (2020). Enhanced monitoring accuracy and test performance: Incremental effects of judgment training over and above repeated testing. *Learning and Instruction*, 65, 101245. [10.1016/j.learninstruc.2019.101245](https://doi.org/10.1016/j.learninstruc.2019.101245)

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Current themes of research:

Motivation to learn

Motivational conflicts

Academic procrastination

Self-regulation in everyday life

Ambulatory assessment

Most relevant publications in the field of Psychology of Education:

Capelle, J. D., Grunschel, C., Bachmann, O., Knappe, M., & Fries, S. (2022). Multiple action options in the context of time: When exams approach, students study more and experience fewer motivational conflicts. *Motivation and Emotion*, 46(1), 16–37. <https://doi.org/10.1007/s11031-021-09912-3>

Fries, S., Dietz, F., & Schmid, S. (2008). Motivational interference in learning: The impact of leisure alternatives on subsequent self-regulation. *Contemporary Educational Psychology*, 33(2), 119–133. <https://doi.org/10.1016/j.cedpsych.2007.10.001>

Grund, A., Brassler, N. K., & Fries, S. (2014). Torn between study and leisure: How motivational conflicts relate to students' academic and social adaptation. *Journal of Educational Psychology*, 106, 242–257. <https://doi.org/10.1037/a0034400>

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Current themes of research:

Self-regulated learning

Learning with multimedia

Cognitive load

Modeling of competencies

Study success in higher education

Most relevant publications in the field of Psychology of Education:

Brünken, R., Plass, J. L. & Leutner, D. (2003). Direct measurement of cognitive load in multimedia learning. *Educational Psychologist*, 38, 53–61. https://doi.org/10.1207/S15326985EP3801_7

Höfler, T.N., & Leutner, D. (2007). Instructional animations versus static pictures: a meta-analysis. *Learning & Instruction*, 17, 222–238. <https://doi.org/10.1016/j.learninstruc.2007.09.013>

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Leutner, D., Leopold, C. & Sumfleth, E. (2009). Cognitive load and science text comprehension: Effects of drawing and mentally imagining text content. *Computers in Human Behavior*, 25, 284–289. <https://doi.org/10.1016/j.chb.2008.12.010>

Wirth, J., Stebner, F., Trypke, M., Schuster, C. & Leutner, D. (2020). An interactive layers model of self-regulated learning and cognitive load. *Educational Psychology Review*, 32, 1127–1149. <https://doi.org/10.1007/s10648-020-09568-4>

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Current themes of research:

Self-regulation in learning and problem solving

Training and intervention research

Authenticity in the communication of scientific work

Citizen science and science communication

Most relevant publications in the field of Psychology of Education:

Kryshko, O., Fleischer, J., Waldeyer, J., Wirth, J., & Leutner, D. (2020). Do motivational regulation strategies contribute to university students' academic success? *Learning and Individual Differences*, 82. <https://doi.org/10.1016/j.lindif.2020.101912>

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Current themes of research:

Self-regulated learning

Procrastination

Motivation and motivational regulation

Learning success and study dropout

Most relevant publications in the field of Psychology of Education:

Grunschel, C., Patrzek, J., & Fries, S. (2013). Exploring reasons and consequences of academic procrastination: An interview study. *European Journal of Psychology of Education*, 28(3), 841–861.

Grunschel, C., Patrzek, J., Klingsieck, K. B., Fries, S. (2018). "I'll stop procrastinating now!" Fostering specific processes of self-regulated learning to reduce academic procrastination. *Journal of Prevention & Intervention in the Community*, 46(2), 143–157. <https://doi.org/10.1080/10852352.2016.1198166>

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