Dynamic Reciprocal Relations of Achievement Goals with Daily Experiences of
Academic Success and Failure: An Ambulatory Assessment Study

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Author note: This study was funded by the German Research Foundation (DFG;
Deutsche Forschungsgemeinschaft; Grant SCHM 2411/9-1).

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Acknowledgments

We thank Aamir Sajjad, Heiko Rölke, and the Technology-Based Assessment Group
at the DIPF for developing and providing the software we used to assess the children's
experiences and performance via smartphones. We further owe special thanks to Anna-Maria
Grimm, Michaela Menstell, Elena Galeano Weber, and a team of highly committed student
assistants for their important roles in conducting the SASCHA project.

Draft version March 17, 2022. This paper has not been peer reviewed.

Abstract

Achievement goals have been linked to achievement in various educational settings. The present work explored day-to-day variations in achievement goals (mastery, performance-approach, performance-avoidance) and their associations with daily experiences of academic success and failure. Ambulatory assessment data from 108 students in Grade 5 were collected, with daily assessments of achievement goals in the morning and end-of-day reports of academic success and failure. Dynamic structural equation models revealed reciprocal within-person effects between mastery goals and academic success. Academic success was further associated with higher mastery and performance-approach goals in the next morning. Academic failure was linked to both performance goals, though this association was not robust in all sensitivity analyses. Higher average daily academic success and lower average academic failure were linked to better academic achievement one year later. Findings suggest meaningful within-person dynamics among goals and daily academic success and failure.

Keywords: experience sampling; dynamic structural equation model; intensive longitudinal data; within-person dynamics

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1. Introduction

Achievement goal theory constitutes one of the most widely used frameworks to investigate motivation. It defines “the kinds of goals (purposes or reasons) that direct achievement-related behavior” (Maehr & Zusho, 2009, p. 77) and distinguishes among mastery goals aiming at improving one’s skills and developing competence, and performance goals focusing on demonstrating competence and avoiding to show a lack of skills (Dweck, 1986; Maehr & Zusho, 2009). In countless studies, researchers have investigated the association among achievement goals and academic outcomes such as learning, engagement, self-efficacy, and achievement (see, e.g., Huang, 2016; Hulleman et al., 2010; Wirthwein et al., 2013). In this regard, prior work has treated achievement goals as stable dispositions or as constructs changing over longer periods of time (e.g., across months or years; see Anderman & Midgley, 1997; Spinath & Spinath, 2005). In contrast, in the present study, we build on recent research demonstrating that goal setting is not a fixed trait, but may vary from day to day or even within days (Goetz et al., 2016; Martin et al., 2019). Thus, we examined the dynamic interplay of school-related achievement motivation with daily experiences of academic success and failure in a smartphone-based ambulatory assessment study with school children of Grade 5, which allowed us to target within-person processes in children’s everyday lives directly after the transition to secondary school. In addition to focusing on these day-to-day within-person processes, we explored the consequences of these daily experiences for long-term outcomes, specifically, for academic achievement reported one year later. We targeted the time period right after the transition to secondary school, because youths are facing major changes in their educational environment during this time, including new subjects and new social comparison groups (Eccles et al., 1993) and previous research has emphasized the importance of studying achievement goals during this time (e.g.,

Anderman & Midgley, 1997; Scherrer et al., 2020). As school-related motivation decreases from late childhood through adolescence (Eccles et al., 1993; Gottfried et al., 2007; Scherrer et al., 2020; Spinath & Spinath, 2005), understanding the mechanisms underlying this developmental trend is an essential prerequisite for developing interventions that may prevent loss in academic motivation and thereby improve academic achievement.

1.1. Achievement Goals and Academic Outcomes

In research on academic outcomes in the school context, achievement goals have played a centrally important role (e.g., Huang, 2012, 2016; Hulleman et al., 2010; Wirthwein et al., 2013). Achievement goals are often classified as mastery goals, performance-approach goals, and performance-avoidance goals (Elliot, 1999; Elliot & Church, 1997), a classification that is referred to as the trichotomous model of achievement goals (Elliot & Harackiewicz, 1996). Mastery goals, also termed learning goals (Dweck, 1986), refer to goals that are targeted toward individual development of competence and a continuous improvement of one's skills. Hence, individuals pursuing mastery goals tend to focus on opportunities to develop one's competence by approaching challenging tasks. Performance goals, in contrast, refer to a stronger focus on comparisons to other people: Rather than perceiving achievement situations as a chance to improve one's skills (an intra-individual perspective), individuals pursuing performance goals tend to compare their performance relative to other individuals (an inter-individual perspective). Performance goals can be either focused on outperforming others (performance-approach goals) or on not underperforming others (performance-avoidance goals).¹

Prior work has often linked mastery goals to positive outcomes such as intrinsic motivation (Dickhäuser et al., 2016; Elliot & Harackiewicz, 1996; Schwinger et al., 2016),

¹ In the 2x2 approach to achievement goals, a similar distinction between approach and avoidance goals has also been made for mastery goals (Elliot & McGregor, 2001) with mastery-avoidance goals pertaining, for example, to not fully realizing one's potential or to lose competency that already had been achieved. We refrained from including this dimension in our study as mastery-avoidance goals are rarely reported by students (Lee & Bong, 2016).

academic interest (Scherrer et al., 2020), and academic achievement (Scherrer et al., 2020; Schwinger et al., 2016). Findings on performance goals emphasize the need to distinguish approach and avoidance goals (Elliot, 1999; Murayama et al., 2011). Specifically, performance-avoidance goals are often associated with more negative outcomes such as lower achievement and academic interest (Scherrer et al., 2020), task involvement (Elliot & Harackiewicz, 1996), or task and job performance (Payne et al., 2007). In contrast, the literature has revealed mixed findings on correlates of performance-approach goals. There are studies showing performance-approach goals to be associated with positive educational outcomes such as achievement (Huang, 2012), or intrinsic motivation (Elliot & Harackiewicz, 1996). However, there is also substantial evidence for performance-approach goals to be unrelated or even negatively related to performance outcomes (Midgley et al., 2001; Payne et al., 2007).

In the vast majority of previous studies, achievement goals have been treated as stable dispositions or as constructs changing over longer periods of time. However, there exists evidence that goal setting in academic contexts is not a fixed trait but varies from day to day (Goetz et al., 2016) or from lesson to lesson in school (Martin et al., 2019). Hence, achievement goals also vary more dynamically on a day-to-day or within-day basis. To accommodate the dynamic nature of achievement goals, we employed an ambulatory assessment study in the school context, in which school children were repeatedly (each day for four weeks) asked about their achievement goals for the upcoming school day. This approach allowed us to examine the extent to which children's achievement goals vary from day to day and to also test if this within-person variation is linked to daily experiences, more specifically, to perceived academic success and academic failure.

1.2 Achievement Goals and Daily Academic Experiences

As noted earlier, previous research has in part revealed mixed findings on the association among achievement goals (especially performance-approach goals) and academic

achievement. While positive associations of mastery goals and achievement (Niepel et al., 2014; Paulick et al., 2013; Scherrer et al., 2020; see also Huang, 2012, for a meta-analysis) as well as negative associations of performance-avoidance goals and achievement (Dinger et al., 2013; Scherrer et al., 2020; Wolters, 2004; see also Huang, 2012, for a meta-analysis) have been documented rather consistently, the evidence regarding performance-approach goals is mixed: There are studies finding negative or nonsignificant associations with academic achievement (Scherrer et al., 2020), whereas other studies show positive associations (Dinger et al., 2013; Wolters, 2004). Academic achievement was primarily operationalized as GPAs in these prior studies. As children's GPAs, in part, result from their everyday successes and failures at school (e.g., participation during lessons, achievements in exams), it is essential to investigate the relations among achievement goals and academic experiences in children's daily lives. In a daily-diary study, Witkow and Fuligni (2007) reported positive effects of both (trait) mastery goals and performance-approach goals on daily reports of school success in a sample of adolescents. That is, adolescents who reported higher mastery goals and performance-approach goals reported school success on more days across a 2-week daily-diary period. No associations of performance-avoidance goals with daily school success were found. Notably, this study did not target day-to-day fluctuations² in achievement goals, but treated this construct as a stable, trait-like variable. To investigate the potential dynamic within-person associations of achievement goals with academic success and failure, respectively, we used an intensive longitudinal design in the current work, with repeated measures of daily achievement goals and daily academic experiences. Given prior work suggesting rather consistent positive effects of mastery goals and negative effects of performance-avoidance goals on academic achievement (Huang, 2012), we expected that daily mastery goals would be linked to higher perceived academic success on the same day

² We use the term fluctuations to refer to any changes within individuals across time. In this sense, fluctuations can be systematic (i.e., related to environmental input or other experiences) or unsystematic (random variation).

(H1). In contrast, daily performance-avoidance goals were expected to be linked to experiences of academic failure on the same day (H2). For performance-approach goals, we built on the daily-diary study by Witkow and Fuligni (2007) and hypothesized a positive association with academic success on the same day (H1).

1.3 Achievement Goals and Daily Academic Experiences: A Reciprocal Link?

When it comes to the reverse direction of the effects, an individual's perception of academic success has also been postulated to be associated with achievement goals. For example, Elliot and Church (1997) suggested that perceptions of high abilities in a particular domain should lead to the adoption of higher mastery goals, higher performance-approach goals, and lower performance-avoidance goals. The evidence on this prediction is, however, rather equivocal. For example, in a longitudinal study with elementary school children, school-related perceived competence was not related to subsequent learning motivation (Spinath & Spinath, 2005). In contrast, Dinger et al. (2013) reported positive associations of perceived competence with mastery goals and performance-approach goals in a cross-sectional study with students in upper-secondary school. A similar pattern of findings was reported in a longitudinal study, with perceived competence in Grade 12 predicting mastery goals and performance-approach goals (but not performance-avoidance goals) in Grade 13 (Dickhäuser et al., 2016).

Interestingly, there are some attempts to explore the reciprocal links between academic success and achievement goals (Niepel et al., 2014; Scherrer et al., 2020; Seaton et al., 2014), but the findings remain inconclusive. Notably, perceived competence was mostly operationalized by academic self-concept as a more or less stable and enduring predisposition referring to individuals' perceptions of their general abilities (e.g., "Generally I am good at things we do at school.", Dickhäuser et al., 2016; Dinger et al., 2013; Spinath & Spinath, 2005). Experiences of academic success and failure do, however, vary on a day-to-day level (Bai et al., 2017; Repetti, 1996). These daily fluctuations might have direct consequences for

individuals' achievement goals. Specifically, academic success can be considered an important ingredient for fulfilling individuals' basic psychological need for competence, which, in turn, may induce adaptive achievement goals and intrinsic motivation (Ryan & Deci, 2017). Hence, daily experiences of success might be associated with subsequently higher mastery goals, a hypothesis we aim to test in the present work (H3).³

On the other hand, experiences of failure in school (e.g., the perception that one was unable to do well at something) might thwart the need for competence. Competence thwarting experiences have been associated with diminished adaptive motivation (e.g., disengagement, Earl et al., 2017). However, it has also been proposed that frustrated needs set in motion attempts to restore the thwarted need, and hence, increase subsequent motivation (Sheldon, 2011). These considerations build upon a body of research showing that need frustration is associated with implicit and explicit attempts that have been interpreted as need restorative motivation. For example, experimental frustration of the need for relatedness has led to biased processing of information signaling social inclusion (Dewall et al., 2009). In a similar vein, it might be argued that day-to-day experiences of academic failure could be associated with higher subsequent achievement motivation.

The hypothesis regarding such a need-restorative process has recently been put to a test in an ambulatory assessment study. In this research (Neubauer et al., 2018), there was no consistent evidence that frustration of a basic psychological need was associated with increased motivation to restore this need on the same day or the next day. These findings may suggest that it is important to distinguish the potential effects of need frustration on different motivation constructs. Specifically, need frustration might lead to increases in motivation that helps to remedy the immediate negative effects of need thwarting experiences on well-being.

³ Because performance-approach goals have not consistently emerged as adaptive in prior work - in the sense that they are not as consistently linked to better academic outcomes, e.g., Huang (2012) vs. Payne et al. (2007) - we did not specifically predict a positive link between daily academic success and subsequent performance-approach goals, but examined this link exploratively.

In light of the present research context, performance goals might serve such deficit-reduction oriented purposes (see Lavigne et al., 2011). Based on these considerations, we tested the hypothesis that daily experiences of academic failure might lead to short-term increases in performance goals, but not mastery goals (H4).

1.2. The Present Study

In this work, we examined the correlates of day-to-day fluctuations in achievement goals in a sample of school children of Grade 5. Prior work has often considered achievement goals as more or less stable, person-level variables and has not investigated short-term fluctuations in these constructs (but see Goetz et al., 2016, for an exception). We assessed school children's achievement goals on a daily basis for four consecutive weeks and examined associations of these within-person fluctuations with daily experiences of academic success and failure. We tested the following hypotheses:

H1: Mastery goals and performance-approach goals (but not performance-avoidance goals) predict daily experiences of academic success. That is, on days when children report higher mastery / performance-approach goals than they typically do, they will experience more academic success.

H2: Performance-avoidance goals (but not mastery goals and performance-approach goals) predict daily experiences of academic failure. That is, on days when children report higher performance-avoidance goals than they typically do, they will experience more academic failure.

H3: Daily academic success is associated with more adaptive achievement motivation on the next day. That is, when children report more success than they typically do, they will report higher mastery goals the next morning.

H4: Daily academic failure is associated with a higher performance-goals on the next day. That is, when children report more failure than they typically do, they will report higher performance goals the next morning.

All of these study hypotheses refer to within-person effects. We further examined the potential downstream consequences of daily experiences (achievement goals; daily academic success and failure) for academic achievement. To this end, we investigated whether average daily experiences predicted children's grades at the end of Grade 5. These analyses were exploratory and were intended to provide insight into the relevance of the constructs assessed on a daily level for long-term change in academic achievement.

2. Method

2.1. Sample and Procedure

The data presented here were collected within the [blinded] project which aimed at examining social and academic challenges associated with the transition from primary to secondary school in Germany. It comprised two main measurement bursts, each consisting of a four-week period of ambulatory assessment, and one follow-up assessment. The first measurement burst took place in Grade 4, prior to the transition and the second burst was conducted in Grade 5 right after children had transitioned to *Gymnasium* (the highest academic track) in a German city near [blinded]. Initially, the project had been planned as a longitudinal investigation of the school transition, hence, with the same children participating in all three assessments. However, due to logistic reasons and one school cancelling participation on a short notice, only four children were examined longitudinally across the first and second measurement burst. The present work focuses on the ambulatory assessment study conducted in Grade 5 (i.e., Burst 2) and the follow-up assessment, which took place one year later in Grade 6.

To recruit children for participation in the second burst, research assistants presented the project in all classes of Grade 5 of a secondary school near [blinded], Germany. One year later, the project was again presented in all classes of Grade 6 of the same secondary school and all children were invited to participate – irrespective of whether they had already participated in Grade 5. In both study parts, parents and children could voluntarily subscribe

for study participation by providing written informed consent. In Grade 5, 108 children (48 boys) between 9 and 11 years ($M_{\text{age}} = 10.11$, $SD_{\text{age}} = 0.44$) participated in the study. In 74 households, German was the primary or only language spoken at home. Children's parents were largely employed in full time (101 fathers, 17 mothers) or part time (4 fathers, 69 mothers). In the follow-up assessment (Grade 6), 80 of these 108 children participated. The sample was a convenience sample. For details on the recruitment process see [blinded].

Prior to the start of data collection in both study parts, trained research assistants instructed participating children in how to operate the research smartphones and how to respond to the self-report items. In the ambulatory assessment phase, children received specially programmed research smartphones for the duration of the study (our application was the only available function on the smartphones). During these four weeks, children responded to prompts delivered by the smartphones four times per day (completing a session took about 5 to 15 minutes). The first assessment was scheduled before school (6:00-7:50 am), the second assessment took place at school (9:50 am), the third assessment could be worked on between 3:00-5:15 pm or 4:00-5:45 pm on longer school days, and the fourth assessment was scheduled in the evenings (6:30-8:30 pm). Completing the morning assessment took approximately five to ten minutes, while completing the other sessions took approximately ten to 15 minutes. Only data from the first and last assessment each day (morning and evening) are relevant for the present study. Children could start the assessment at any time point within the given time window. Study participation was voluntary and was rewarded with a gift coupon. Since the relevant daily measures were assessed on schooldays only, only assessments taken during the week were considered in this work. Compliance rates were estimated as the proportion of time points at which at least one of the relevant measures was completed. Of the potentially possible 2,160 data points (108 children x 20 days), 1,854 data points were obtained in the morning session and 1,704 data points were obtained in the

evening session, corresponding to a compliance rate of 85.8% (morning) and 78.9% (evening).

The [blinded] project was approved by the ethics committee of [blinded]. Data and analysis code can be found on this work's OSF repository (https://osf.io/gfvja/?view_only=b87fe179cf134471948726cb0e482a80).

2.2.Measures

Academic Goals. Children's daily academic goals were assessed once per day every morning before school using a 5-point Likert scale with endpoints of 1 ("not at all true") and 5 ("completely true"). The three goals were measured with one item each (mastery: "Today, it is important to me to learn as much as possible.", performance-approach: "Today, it is important to me to perform better than the others.", performance-avoidance: "Today, it is important to me to avoid performing poorly compared to my classmates."). Items were delineated from prior work by Goetz et al. (2016) and focused on the normative aspect (i.e., comparison to other students) of performance goals (cf. Elliot & Thrash, 2001).

Academic Success and Failure. Every evening on school days, children indicated their perceived success and failure at school using six items referring to experiences in school today (see Online Supplement for wording in German, and English translation). All items were answered on the same 5-point Likert scale as the previous items. These items were delineated from prior work assessing academic events and questionnaires assessing satisfaction and frustration of the basic psychological need for competence (Neubauer & Voss, 2016; Sheldon & Hilpert, 2012). A multilevel confirmatory factor analysis showed that the expected two factor solution with a success factor and a failure factor both at the between- and the within-person level adequately described the data (see Online Supplement S1 for details). Reliability, estimated as multilevel McDonald's ω (Geldhof et al., 2014) was satisfactory in this sample (within: $\omega = .807 / .748$ [success / failure]; between: $\omega = .978 / .948$ [success / failure]).

Academic Achievement. Both children and parents reported grades in the final report card for Mathematics, German, and English in Grade 4. In the follow-up assessment, children reported the grades they received in the final report cards of Grade 5. Grades were averaged from both children's and parents' reports (Grade 4) and from children's reports in Grade 5. For better interpretability, grades were recoded with 1 representing lowest achievement and 6 representing best achievement.

2.3.Data Analysis

We used the statistical software package R version 4.1.1 (R Core Team, 2021) for data preparation and basic data analyses. The packages *plyr* (Wickham, 2011) and *psych* (Revelle, 2021) were used for data preparation and descriptive analyses. The *nlme* package (Pinheiro et al., 2021) was used to estimate the intra-class correlations and the *MplusAutomation* package (Hallquist & Wiley, 2018) was used as an interface between R and Mplus.

To test our study hypotheses, we used dynamic structural equation modeling (DSEM; Asparouhov et al., 2018; Hamaker et al., 2018) in Mplus version 8.6. This approach has recently been proposed to combine multilevel modeling (which allows for accounting for the nested data structure with daily assessments on Level 1 nested within children on Level 2)⁴ with time-series modeling to investigate the lead-lag relation between repeatedly assessed variables. In the present work, the three goal variables and daily academic success and failure were entered into the model. The model decomposes the five observed variables into a within-person and a between-person component, respectively. These unobserved components can then be considered as latent variables on the within-person and the between-person level,

⁴ DSEM is currently restricted to two-level models and therefore we did not add children's classes as an additional level of nesting. There were only six different classes and children were relatively evenly distributed across these classes (average class size = 18, range = 13-23). Estimating the class-level variance for the five repeatedly measured variables showed that the proportion of variance on the class level (the ICC, variance on the class-level relative to the total variance) was smaller than 2.1% for all (largest for academic failure; for the other four variables the ICC was smaller than 1%).

respectively. This variance decomposition allows for interpreting the effects of the time-varying predictors as estimates of the pure within-person effects (Wang & Maxwell, 2015). On the within-person level, we added autoregressive effects for all five variables with mastery goals (performance-approach goals / performance-avoidance goals / success / failure) on day d predicting mastery goals (performance-approach goals / performance-avoidance goals / success / failure) on day $d+1$. Further, the three goals (assessed in the morning) were added as predictors of academic success and failure reported on the same day in the evening. Success and failure were, in turn, added as predictors of goals in the next morning. Residual covariances among the contemporaneously assessed variables were estimated. Further, random slopes were added for the 12 cross-regression coefficients. On the between-person level, the correlations of the five variables (the five random intercepts) were freely estimated. A schematic representation of the model on the within-person level is depicted in Figure 1. See the Online Supplement S2 for a formal representation of the model as well as a graphic illustration of the full model (Figure S1).

The DSEM framework allows to explicitly incorporate unequally spaced inter-measurement intervals in the estimation of auto- and cross-lagged effects. In the present case, relevant observations were only obtained on schooldays, not on the weekends. The present analyses account for the longer measurement interval between Friday evening and Monday morning by inserting missing observations on weekend days. These missing observations are assumed to be missing at random given all predictors in the model (as are missing observations due to non-completed assessments). DSEM requires a Bayesian estimator. For the present analyses, we kept the Mplus defaults of diffuse priors and a burn-in period of 50%. Results are based on two Markov Chain Monte Carlo (MCMC) chains with 3000 iterations after keeping only every 50th iteration (thinning = 50) to reduce autocorrelation between the MCMC draws (for a detailed introduction to the DSEM framework see, e.g., Asparouhov et al., 2018; Hamaker et al., 2018; McNeish & Hamaker, 2020). Reported estimates are the

medians of the resulting posterior parameter distributions with their associated 95% credible intervals. Parameters whose 95% credible interval do not contain zero were considered statistically meaningfully different from zero (analogously to the two-tailed 5% α -level used for all other analyses reported in this work).

3. Results

3.1.Descriptive Statistics

Descriptive statistics are reported in Table 1. Daily goals were positively correlated amongst each other; correlations were in a similar range as reported in prior work by Goetz et al. (2016). Variance decomposition using the intra-class correlation showed that between 39.0% and 44.6% of the total variance in the variables assessed on a daily level could be attributed to stable between-person differences. Hence, findings suggest that there is meaningful within-person, day-to-day variability in goals, academic success, and academic failure.

3.2.Day-to-Day Dynamics: Achievement Goals, Academic Success and Failure

The two chains of the DSEM converged successfully with a potential scale reduction of 1.003. Visual inspection of the trace plots and autocorrelation plots of the estimates suggested successful convergence. Results (see Table 2) revealed positive autocorrelations of all five variables.

Results further showed that daily academic success was predicted by mastery goals, $\beta = .255$, 95% credible interval [.186, .319], but the associations with performance-approach goals, $\beta = -.028$, [-.083, .030], and performance-avoidance goals, $\beta = .050$, [-.011, .112], were not statistically meaningful. Hence, findings only partially supported our first research hypothesis. In line with our second hypothesis, performance-avoidance goals, $\beta = .086$, [.023, .149], but not performance-approach goals, $\beta = .050$, [-.012, .112], and mastery goals, $\beta = -.022$, [-.088, .042], significantly predicted daily experiences of academic failure.

Across-day effects revealed that experiences of academic success were, as hypothesized in our third research hypothesis, associated with more mastery goals in the next morning, $\beta = .256$, [.203, .309]. In addition, academic success was also associated with an increase in performance-approach goals, $\beta = .068$ [.014, .126], and performance-avoidance goals in the following morning, $\beta = .163$ [.104, .216]. Further, and supporting Hypothesis 4, academic failure was associated with higher performance-avoidance goals, $\beta = .069$ [.013, .123], and performance-approach goals, $\beta = .072$ [.014, .127], in the next morning.

We tested whether the model results of the DSEM would be stable in two sensitivity analyses. In alternative Model 1, we treated the three single-item constructs (the three daily goals) as ordered categorical variables and re-estimated the DSEM. The pattern of results remained unchanged (see Table S2 in the Online Supplement S3). In alternative Model 2, we estimated covariances among all random effects, that is, all random slopes and intercepts. In this analysis, the effects were estimated as smaller compared to the results in the original model (see also see Table S2 in the Online Supplement S3). Further, some regression coefficients that had been statistically significant were no longer significant in this analysis: Academic failure now no longer significantly predicted next day's performance-approach goals, $\beta = .049$ [-0.008, .106], or performance-avoidance goals, $\beta = .040$ [-.018, .097]. Further, the link between performance-avoidance goals and same-day academic failure was no longer statistically significant either, $\beta = .066$ [-.006, .138].

3.3. Predicting Grades

In a last step, we predicted children's academic achievement (grades in Grade 5) from prior achievement (grades in Grade 4) as well as the means of the daily reports on achievement goals, as well as academic success and failure. All predictors were z -standardized, the dependent variable was kept in its original metric (to preserve the interpretable metric of this variable). Prior achievement accounted for 23.2% of the variance in Grade 5 achievement. Adding achievement goals increased explained variance to 31.7%.

Mastery goals predicted better grades, $b = .206$, $p = .023$, and performance-approach goals predicted worse grades, $b = -.239$, $p = .011$. After including academic success and failure as additional predictors, the effects of achievement goals were no longer statistically meaningful, $p > .065$. Children who reported more academic success, $b = .317$, $p = .001$, and less academic failure, $b = -.244$, $p < .001$, during the four-week observation period reported better grades at the end of Grade 5.

4. Discussion

The present work examined day-to-day fluctuations in school children's mastery goals, performance-approach goals, and performance-avoidance goals. Using data from a four-week long ambulatory assessment study, we examined the interplay of within-child fluctuations in achievement goals with daily subjective academic success and failure.

4.1. Achievement Goals: Day-to-Day Variation and Associations with Academic Success and Failure

Descriptive statistics revealed substantial day-to-day variation in achievement goals across four weeks. That is, achievement goals exhibited clear signs of state characteristics, echoing and extending prior work in this area. Specifically, Goetz et al. (2016) linked within-person fluctuations of achievement goals to momentary achievement emotions. Martin et al. (2019) also assessed goals repeatedly and found state-like characteristics of these constructs, with goals varying from lesson to lesson. Notably, the largest portion of within-person variability in achievement goals reported by Martin et al. (2019) could be attributed to within-day fluctuations (which represented differences between Math and English lessons). In our study, achievement goals were assessed in a more global fashion (referring to the whole school day, not to a specific subject). This may indicate that domain-specific goals (as assessed in Martin et al., 2019) may be more stable across days than global achievement goals as assessed in our work.

Day-to-day fluctuations in global achievement goals were linked to day-level outcomes in a by and large anticipated pattern: Children reported more academic success on days on which they had a higher mastery goals. That is, when children reported that it was important for them to learn as much as possible in school today, they reported more experiences of accomplishment later that day. Our findings highlight the need to differentiate performance goals into approach and avoidance components, as they were differentially related to daily outcomes: Whereas performance-approach goals were not meaningfully related to either daily academic success or failure, performance-avoidance goals were associated with more experiences of academic failure. That is, on days when it was important to children to not underperform others, they reported more failure later that day. This association might indicate that children anticipated failure in the morning (e.g., because they expected a difficult upcoming task at school) and responded to this expectation with a higher performance-avoidance goals (e.g., as a means of proactive or anticipatory coping, see Neupert et al., 2019). Hence, this link does not necessarily have to indicate that performance-avoidance goals lead to failure, but it might implicate that the anticipation of negative events leads to both, performance-avoidance goals in the morning and the experiences of failure later that day. The link between performance-avoidance goals and academic failure later that day was, however, not robust in all sensitivity analyses. Further, the effect was comparatively weak and smaller than the effect of mastery goals on subsequent success. Consequently, this association should be interpreted cautiously. In conclusion, research Hypothesis 1 was partially supported (only mastery goals, but not performance-approach goals were linked to academic success). Research Hypothesis 2 was supported in the main analysis, but the association between performance-approach goals and failure was not robust in all sensitivity analyses.

Daily experiences of success and failure at the beginning of the school year emerged as predictors of academic achievement later in that year – even after accounting for prior

achievement. Notably, achievement goals did not account for unique variance in academic achievement after controlling for daily academic success and failure. Because mastery goals and (albeit to a lesser extent) performance-avoidance goals emerged as meaningful predictors of day-to-day fluctuations in experiences of academic success and failure, respectively, these findings align with work by Witkow and Fuligni (2007) and suggest that daily academic experiences may help explaining the effects of achievement goals on academic achievement. The present study extended prior work by targeting the dynamic within-person association between achievement goals and daily experiences and suggests that this dynamic interplay may be a driving force behind the development of academic achievement.

4.2. Daily Experience of Academic Success and Failure as Predictors of Subsequent Achievement Goals

Prior work suggested that perceived competence is an important antecedent of achievement goals (Dinger et al., 2013; Elliot & Church, 1997). To examine if this association might be driven by day-level changes in achievement goals in response to experiences of accomplishment or failure, we examined the across-day associations of academic success and failure with next day's achievement goals. Our findings suggest that when children report more academic success than they usually do, they experience a boost in all three achievement goals on the next day. Although the effect of success on mastery goals was descriptively strongest and the effect on performance-avoidance goals was not robust in all sensitivity analyses, these findings suggest that experiences of success do not have effects on specific achievement goals, but they might impact all three investigated achievement goals. Overall, these findings are in line with research Hypothesis 3 in which we predicted higher mastery goals after days with more academic success.

When interpreting these findings through the lenses of Self-Determination Theory (Ryan & Deci, 2017), they indicate that satisfaction of the need for competence might trigger subsequent adaptive motivation (mastery goals). This particular pattern is in line with the

process of internalization of motivation, which is central to the idea on the development of intrinsic motivation proposed in Self-Determination Theory. Our findings suggest that achievement goals are malleable by academic experiences made on a daily basis. This implies that positive academic experiences might lead to a shift of achievement motivation and increase mastery goals. This may create a ripple effect, with mastery goals facilitating further academic success.

In contrast, and in line with our Hypothesis 4, the effects of failure experiences were only statistically meaningful for next day's performance goals, but not mastery goals. Such instances of frustration of the need for competence (Ryan & Deci, 2017) may have triggered children to set performance goals in order to avoid further experiences of need frustration (see Sheldon, 2011). By increasing performance goals after experiences of failure, short-term effects on negative consequences of need frustration (e.g., on negative affect) may be prevented, but this may come at the expense of long-term costs in terms of academic achievement, in particular if performance-avoidance goals are set in response to competence frustration. However, here, too, all effects involving academic failure were comparatively small in size and not robust in all sensitivity analyses. That is, while these results lend initial support to our hypotheses, further research is needed to replicate these findings.

4.3.Limitations

A number of limitations need to be considered when interpreting the results of this study. First, achievement goals were not assessed for specific school subjects, but for the whole school day. Part of the observed day-to-day fluctuations might therefore be attributed to different lesson schedules. There is some evidence suggesting that domain-specific achievement goals vary less from day to day or week to week than they vary across domains (Martin et al., 2019). Goals as assessed in the present study might either be a mix of different subject-specific goals students hold on this day or they might represent a student's most distinct goal on this day. Future research should consider assessing both goals and indicators

of daily academic success and failure in a more domain-specific fashion. Second, performance goals were assessed as normative goals (performing better or not worse than others). Whether the pattern of results would differ for appearance performance goals (the goal to demonstrate competence; see e.g., Lüftenegger et al., 2019) is a question that would require future research. Third, although the constructs of interest were taken at different assessment occasions, the lead-lag association found here cannot unequivocally be interpreted as evidence for causal effects. Experimental approaches that induce different goal states on different days (or experiences of success and failure) would be needed to test if the reported effects are truly causal (Schmiedek & Neubauer, 2020). Fourth, the across-day effects of experiences of success and failure on next day's goals may not generalize to potential within-day effects of these experiences, and these effects might be stronger when considering the immediate effects of success and failure on goals. In contrast, however, a successful experience might also reduce performance goals directly after the event, because the need for competence is satiated. To examine the dynamic interplay between achievement goals and daily experiences on different time scales, temporally more dense assessments throughout the day will be required.

4.4. Conclusion

Children vary from day to day in the achievement goals they set for the upcoming school day. When children set more mastery goals in the morning, they reported more experiences of academic success later that day. In contrast, days with more performance-avoidance goals in the morning were days with more experiences of academic failure. Daily experiences of success and failure were linked to achievement goals on the next day: After more successful days, children set more achievement goals in general. Experiences of failure were associated with higher performance goals, but not mastery goals, on the next day. Better understanding the day-to-day experiences of academic success and failure is essential because they are associated with subsequent academic achievement.

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Table 1

Descriptive Statistics

	Correlations							Mean (<i>SD</i> between)	Possible Range
	1	2	3	4	5	6	7		
1 Mastery Goals		.556	.781	.847	.112	-.063	.105	4.16 (0.769)	1-5
2 Performance-Approach Goals	.359		.725	.459	.437	-.092	-.275	3.27 (0.998)	1-5
3 Performance-Avoidance Goals	.434	.466		.621	.125	-.059	-.013	3.79 (0.912)	1-5
4 Academic Success	.356	.097	.188		.154	-.072	.229	3.94 (0.763)	1-5
5 Academic Failure	.073	.118	.142	.205		-.182	-.516	2.65 (0.863)	1-5
6 Grades in Grade 4	-	-	-	-	-		.484	5.42 (0.410)	1-6
7 Grades in Grade 5	-	-	-	-	-	-		4.56 (0.677)	1-6
<i>SD</i> within	0.918	1.112	1.074	0.917	1.079	-	-		
ICC	.412	.446	.419	.409	.390	-	-		

Note. Estimates below the diagonal refer to descriptive statistics on the within-person level, estimates above the diagonal to the between-person level. Please note that grades scored so that high scores represent high achievement. ICC = intra-class correlation. $N = 108$.

Table 2

Results from the Dynamic Structural Equation Model: Reciprocal Relations of Daily Achievement Goals and Academic Success and Failure

	Unstandardized Estimates	Standardized Estimates
Autoregressive effects		
Mastery	.232 [.181, .279]	.233 [.183, .279]
Performance-Approach	.337 [.290, .386]	.337 [.290, .387]
Performance-Avoidance	.270 [.222, .316]	.270 [.223, .317]
Success	.234 [.171, .294]	.234 [.172, .294]
Failure	.197 [.138, .255]	.197 [.138, .252]
Cross-regressive effects		
Success → Mastery	.264 [.187, .341]	.256 [.203, .309]
Failure → Mastery	.002 [-.061, .068]	.004 [-.047, .057]
Success → Performance-Approach	.090 [.003, .182]	.068 [.014, .126]
Failure → Performance-Approach	.077 [.009, .144]	.072 [.014, .127]
Success → Performance-Avoidance	.200 [.110, .289]	.163 [.104, .216]
Failure → Performance-Avoidance	.070 [.007, .130]	.069 [.013, .123]
Mastery → Success	.272 [.185, .361]	.255 [.186, .319]
Performance-Approach → Success	-.025 [-.076, .032]	-.028 [-.083, .030]
Performance-Avoidance → Success	.046 [-.016, .111]	.050 [-.011, .112]
Mastery → Failure	-.026 [-.110, .057]	-.022 [-.088, .042]
Performance-Approach → Failure	.051 [-.019, .119]	.050 [-.012, .112]
Performance-Avoidance → Failure	.087 [.024, .154]	.086 [.023, .149]
Random variances		
Success → Mastery	.076 [.047, .121]	-
Failure → Mastery	.047 [.023, .083]	-
Success → Performance-Approach	.070 [.030, .133]	-
Failure → Performance-Approach	.031 [.006, .069]	-
Success → Performance-Avoidance	.094 [.048, .162]	-
Failure → Performance-Avoidance	.016 [.002, .048]	-
Mastery → Success	.065 [.032, .119]	-
Performance-Approach → Success	.018 [.005, .039]	-
Performance-Avoidance → Success	.033 [.011, .067]	-
Mastery → Failure	.028 [.004, .076]	-
Performance-Approach → Failure	.028 [.005, .065]	-
Performance-Avoidance → Failure	.012 [.001, .040]	-
Explained Variance (Level-1 R^2)		
Mastery	-	.306 [.260, .349]
Performance-Approach	-	.234 [.188, .279]
Performance-Avoidance	-	.229 [.185, .275]
Success	-	.308 [.257, .362]
Failure	-	.135 [.098, .177]

Note. Table displays unstandardized and standardized regression coefficients and variances of random effects (95% credible interval in parentheses). Fixed effects whose 95% credible

interval does not contain zero are highlighted in bold face. Only the results of the within-person associations are reported; see Mplus output in the OSF repository

(https://osf.io/gfvja/?view_only=b87fe179cf134471948726cb0e482a80) for full results. $N = 108$.

Table 3

Predicting Grades from Average Daily Experiences (Achievements Goals, Academic Success and Failure)

	Model 1	Model 2	Model 3
Intercept	4.577* (.067)	4.577* (.063)	4.577* (.055)
Grades in Grade 4	.323* (.067)	.319* (.064)	.289* (.056)
Average Mastery Goals	-	.206* (.088)	-.058 (.108)
Average Performance-Approach Goals	-	-.239* (.091)	-.158 (.085)
Average Performance-Avoidance Goals	-	.038 (.108)	.015 (.095)
Average Academic Success	-	-	.317* (.094)
Average Academic Failure	-	-	-.244* (.061)
Adjusted R^2	23.2%	31.7%	48.0%

Note. Table depicts unstandardized coefficients from ordinary least squares regressions (standard errors in parentheses). All predictors were z-standardized prior to the analyses. Grades were recoded with 6 being the best grade and 1 being the lowest grade. Hence, the regression coefficients can be interpreted as differences in grade units per one standard deviation difference in the independent variables. For seven children, no information on grades in Grade 4 were available; for another 27 children no information on grades in Grade 5 were available, resulting in $N = 74$.

* $p < .05$.

Figure 1. Schematic representation of the within-person part of the dynamic structural equation model. Arrows with black circles represent regression coefficients that were estimated as random effects. All effects (represented by one-headed arrows) were estimated in the model. Dashed arrows represent effects that were estimated but not statistically meaningful in the main model. Solid arrows represent effects that were statistically significant in the main analyses. Bold red arrows represent effects that were stable also in the sensitivity analyses. Residual covariances between academic success and failure, and among the three goal measures were estimated but are not depicted.

SUPPLEMENT:**S1: Multilevel Confirmatory Factor Analysis**

We examined the factor structure of the six items assessing academic success and failure via multilevel confirmatory factor analysis in Mplus version 8.6 using robust maximum likelihood (MLR) estimation. Based on prior work on the structure of need fulfillment (Sheldon & Hilpert, 2012; Neubauer & Voss, 2018), we anticipated that a two-factor model (with one success factor and one failure factor) would adequately fit the data. Results suggested acceptable fit of a model with two factors on both the between- and the within-person level: $\chi^2(16) = 66.794$, scaling correction factor = 1.310, comparative fit index (CFI) = .969, root mean square error of approximation (RMSEA) = .043, standardized root mean square residual (SRMR) = .044 (within) / .072 (between).⁵ The two factors were not statistically meaningfully correlated on the between-person level, $r = .142$, $p = .181$. On the within-person level, the correlation was statistically significant, $r = .218$, $p = .005$. Note that the correlation was *positive*, indicating that days with more success tended to be days with more failure as well. This pattern emphasized that success and failure are not psychometric opposites of a unidimensional factor (this would imply a perfect *negative* correlation between success and failure). Table S1 depicts the wording of the six items (German original wording and English translation) as well as standardized factor loadings estimated in the multilevel confirmatory factor analysis.

⁵ We deemed CFI > .90 (> .95), RMSEA < .08 (.06), and SRMR < .08 (.06) as adequate (good) model fit.

Table S1

Factor Loadings in the Multilevel Confirmatory Factor Analysis

	Success within	Success between	Failure within	Failure between
<i>Heute habe ich etwas im Unterricht gut hinbekommen.</i> (Today at school, I did well at something.)	.747	.981	-	-
<i>Heute habe ich im Unterricht eine schwierige Aufgabe gelöst.</i> (Today at school, I completed a difficult task.)	.725	.941	-	-
<i>Heute war ich im Unterricht erfolgreich, selbst bei schwierigen Dingen.</i> (Today at school, I did well even at the hard things.)	.825	.980	-	-
<i>Heute habe ich etwas im Unterricht nicht geschafft.</i> (Today at school, I failed at something.)	-	-	.617	.778
<i>Heute hatte ich das Gefühl, im Unterricht bei etwas versagt zu haben oder nicht gut gewesen zu sein.</i> (Today at school, I experienced some kind of failure, or was unable to do well at something.)	-	-	.783	1.030
<i>Heute habe ich mich im Unterricht nicht so schlau gefühlt.</i> (Today at school, I didn't feel too smart.)	-	-	.717	.939

Note. Table depicts standardized loadings. Items were presented in German. All loadings were statistically significant, $p < .001$.

S2: Additional Information on the DSEM

Each of five observed variables mastery goals (mg), performance-approach goals (pap), performance-avoidance goals (pav), success (succ), and failure (fail) is first decomposed into a within-person component and a between-person component. Following notation introduced by Hamaker et al. (2018), participant i 's observation on day d ($Y_{i,d}$) is hence decomposed into a between-person component $\mu_{Y,i}$ and a within-person component $Y_{i,d}^{(W)}$:

$$mg_{i,d} = \mu_{mg,i} + mg_{i,d}^{(W)} \quad (S1)$$

$$pap_{i,d} = \mu_{pap,i} + pap_{i,d}^{(W)} \quad (S2)$$

$$pav_{i,d} = \mu_{pav,i} + pav_{i,d}^{(W)} \quad (S3)$$

$$succ_{i,d} = \mu_{succ,i} + succ_{i,d}^{(W)} \quad (S4)$$

$$fail_{i,d} = \mu_{fail,i} + fail_{i,d}^{(W)} \quad (S5)$$

On the within-person level, autoregressive effects for all five variables were added. In addition, effects of goals assessed in the morning of day d to academic success and failure assessed in the evening of the same day were added. Conversely, effects of academic success and failure assessed in the evening of day d on goals assessed in the morning of day $d+1$ were added:

$$mg_{i,d}^{(W)} = \varphi_1 \cdot mg_{i,d-1}^{(W)} + \beta_{11,i} \cdot succ_{i,d-1}^{(W)} + \beta_{12,i} \cdot fail_{i,d-1}^{(W)} + \zeta_{i,d(1)} \quad (S6)$$

$$pap_{i,d}^{(W)} = \varphi_2 \cdot pap_{i,d-1}^{(W)} + \beta_{21,i} \cdot succ_{i,d-1}^{(W)} + \beta_{22,i} \cdot fail_{i,d-1}^{(W)} + \zeta_{i,d(2)} \quad (S7)$$

$$pav_{i,d}^{(W)} = \varphi_3 \cdot pav_{i,d-1}^{(W)} + \beta_{31,i} \cdot succ_{i,d-1}^{(W)} + \beta_{32,i} \cdot fail_{i,d-1}^{(W)} + \zeta_{i,d(3)} \quad (S8)$$

$$succ_{i,d}^{(W)} = \varphi_4 \cdot succ_{i,d-1}^{(W)} + \beta_{41,i} \cdot mg_{i,d}^{(W)} + \beta_{42,i} \cdot pap_{i,d}^{(W)} + \beta_{43,i} \cdot pav_{i,d}^{(W)} + \zeta_{i,d(4)} \quad (S9)$$

$$fail_{i,d}^{(W)} = \varphi_5 \cdot fail_{i,d-1}^{(W)} + \beta_{51,i} \cdot mg_{i,d}^{(W)} + \beta_{52,i} \cdot pap_{i,d}^{(W)} + \beta_{53,i} \cdot pav_{i,d}^{(W)} + \zeta_{i,d(5)} \quad (S10)$$

Residual covariances among the three goal variables were estimated as was the residual covariance between success and failure.

For all cross-regression effects, random effects were estimated (denoted by the subscript i of the regression coefficients), creating 12 latent variables on the between-person level (β_{11} to β_{53}) representing between-person differences in the within-person effects. The means of these 12 variables (denoted as γ) represent the average within-person effects across the sample.

Participant specific deviations from these means are denoted as u :

$$\beta_{11,i} = \gamma_{11} + u_{11,i} \quad (S11)$$

$$\beta_{12,i} = \gamma_{12} + u_{12,i} \quad (S12)$$

$$\beta_{21,i} = \gamma_{21} + u_{21,i} \quad (S13)$$

$$\beta_{22,i} = \gamma_{22} + u_{22,i} \quad (S14)$$

$$\beta_{31,i} = \gamma_{31} + u_{31,i} \quad (S15)$$

$$\beta_{32,i} = \gamma_{32} + u_{32,i} \quad (S16)$$

$$\beta_{41,i} = \gamma_{41} + u_{41,i} \quad (S17)$$

$$\beta_{42,i} = \gamma_{42} + u_{42,i} \quad (S18)$$

$$\beta_{43,i} = \gamma_{43} + u_{43,i} \quad (S19)$$

$$\beta_{51,i} = \gamma_{51} + u_{51,i} \quad (S20)$$

$$\beta_{52,i} = \gamma_{52} + u_{52,i} \quad (S21)$$

$$\beta_{53,i} = \gamma_{53} + u_{53,i} \quad (S22)$$

Please see Figure S1 (next page) for a graphical representation of this model.

Figure S1. A graphical representation of the DSEM model. Observed variables were decomposed into latent within- and between-person components (left part of the figure). Auto- and cross-regressive effects were estimated on the within-person level; random effects for the cross-regression coefficients were estimated (lower right part of the Figure). Correlations among the random intercepts, but not random slopes were estimated on the between-person level (upper right part of the Figure).

S3: Sensitivity Analyses

Table S2

Results from the Dynamic Structural Equation Model: Original DSEM, Goals as Ordered Categorical Variables, Correlated Random Effects

	Original Model	Goals as Ordered Categorical Variables	Correlated Random Effects
Cross-regressive effects			
Success → Mastery	.256 [.203, .309]	.266 [.205, .325]	.228 [.166, .283]
Failure → Mastery	.004 [-.047, .057]	.031 [-.035, .094]	-.010 [-.069, .045]
Success → Performance-Approach	.068 [.014, .126]	.071 [.012, .129]	.058 [-.006, .122]
Failure → Performance-Approach	.072 [.014, .127]	.086 [.022, .145]	.049 [-.008, .106]
Success → Performance-Avoidance	.163 [.104, .216]	.169 [.107, .236]	.120 [.059, .186]
Failure → Performance-Avoidance	.069 [.013, .123]	.084 [.019, .146]	.040 [-.018, .097]
Mastery → Success	.255 [.186, .319]	.303 [.203, .406]	.211 [.132, .288]
Performance-Approach → Success	-.028 [-.083, .030]	-.087 [-.174, .008]	-.020 [-.087, .046]
Performance-Avoidance → Success	.050 [-.011, .112]	.045 [-.048, .134]	.067 [-.004, .129]
Mastery → Failure	-.022 [-.088, .042]	-.051 [-.154, .050]	-.090 [-.172, -.011]
Performance-Approach → Failure	.050 [-.012, .112]	.031 [-.057, .122]	.051 [-.018, .125]
Performance-Avoidance → Failure	.086 [.023, .149]	.162 [.059, .269]	.066 [-.006, .138]

Note. Table displays standardized regression coefficients (95% credible interval in parentheses). Original model is the main model reported in the main text (estimates are the same as in Table 2). In the second model, the three goal variables were treated as ordered categorical data. In the third model (Correlated Random Effects), covariances between random intercepts and random slopes were estimated. Fixed effects whose 95% credible interval does not contain zero are highlighted in bold face. Only the main results of the within-person associations are reported; see Mplus output in the OSF repository (https://osf.io/gfvja/?view_only=b87fe179cf134471948726cb0e482a80) for full results. $N = 108$.

References

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