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*Developmental Science 25 (2022) 6:e13301*

Received: 30 June 2021 | Revised: 24 May 2022 | Accepted: 23 June 2022

DOI: 10.1111/desc.13301

Developmental Science WILEY

RESEARCH ARTICLE

# Day-to-day variation in students' academic success: The role of self-regulation, working memory, and achievement goals

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## Abstract

Self-regulation was found to be positively associated with school performance. Interrelations between self-regulation, working memory (WM), and achievement goals, in particular mastery goals, have been established, as well as associations with academic outcomes. It stands to reason that self-regulation, WM, achievement goals, and academic success are related on a daily level. However, previous research rarely considered this level of analysis. Here, we therefore addressed the relations of daily self-regulation, WM, and achievement goals, and their relevance for daily and general academic success. Data were obtained through ambulatory assessments in 90 students before (Study 1; $M_{age} = 9.83$, $SD_{age} = 0.50$) and 108 students after their transition to secondary school (Study 2; $M_{age} = 10.12$, $SD_{age} = 0.45$) across 20 school days. Students reported about daily achievement goals prior to school, self-regulation at school, and perceived academic success after school, as well as report card grades. Daily WM was assessed at school. Study 1 showed positive associations between daily mastery goals and self-regulation, but not with WM. Together, daily performance-approach goals and self-regulation, but not other goals or WM uniquely contributed to daily perceived academic success. Study 2 showed positive associations between daily mastery goals and self-regulation, but not with WM. Average daily mastery goals predicted daily WM. Together, daily mastery goals and self-regulation, but not WM, uniquely contributed to daily perceived academic success. In both studies, average levels of WM, but not achievement goals or self-regulation predicted report card grades. Results thus corroborate theoretical considerations on the importance of distinguishing self-regulation processes at between- and within-person levels.

KEYWORDS
academic success, achievement goals, ambulatory assessment, school children, self-regulation, working memory

**Research Highlights**

- Analyses of intensive longitudinal data on daily self-regulation, working memory, and achievement goal orientations in the school context of 9- to 11-year-olds.
- In primary and secondary school, days with higher mastery goals and self-regulation are days with higher academic success.
- In primary and secondary school, days with higher mastery goals are days with higher self-regulation.
- In secondary school, students with higher average mastery goals show better daily WM performance.
- Average working memory performance predicts report card grades beyond the influence of prior grades and achievement goal orientations.

## 1 | INTRODUCTION

Previous research on self-regulation—the regulation of cognitions, emotions, and behavior towards a previously specified goal—largely focused on between-person differences and their associations with outcomes (e.g., Carver & Scheier, 1998; Dent & Koenka, 2016). An increasing body of research additionally showed self-regulation (e.g., Ludwig et al., 2016; Schmid et al., 2020), working memory (WM; e.g., Dirk & Schmiedek, 2016), and achievement goals (Martin et al., 2020; Neubauer et al., 2022) to vary within students in the school context, for instance from day to day; yet, there is little research examining associations among these constructs in the school context and distinguishing between- and within-person level effects. However, effects at both levels differ conceptually (e.g., Curran & Bauer, 2010) and may exhibit associations that differ in strength or even direction (Molenaar & Campbell, 2009). Hence, existing theoretical conceptions should be complemented with within-person level findings. These latter findings will furthermore inform practical implications in relation to students' day-to-day support. The present investigation therefore set out to examine the interplay of self-regulation, WM, achievement goals, and academic success at both the between- and the within-person level, using data from two ambulatory assessment studies with 9- to 11-year-olds.

### 1.1 | Self-regulation

Self-regulation denotes active and constructive processes individuals initiate to approach previously specified goals (Baumeister et al., 1994; Carver & Scheier, 1998). While some models consider self-regulation in general and thus independent of the specific context (e.g., Baumeister et al., 1994; Carver & Scheier, 1998), models that specifically consider students' self-regulation in learning situations have been established (e.g., Efklides, 2011; Pintrich, 2000; Winne & Hadwin, 1998; Zimmerman, 2000). The models are consistent in the idea that self-regulation processes serve to monitor, maintain, and dynamically adjust cognitions (e.g., attention; Rueda et al., 2004; Winne, 2011), emotions (e.g., pride, anger; Pekrun et al., 2002), and behavior (e.g., focusing on teachers; Daley & Birchwood, 2010) in the service of goal striving.

Goal setting is considered to initiate self-regulation as it renders the discrepancy between actual and desired states apparent (Carver & Scheier, 1998; Pintrich, 2000; Zimmerman, 2002). Negative discrepancies are assumed to elicit increasing efforts to bring actual states in line with goal standards. Self-regulation processes guide these efforts to adjust cognitions, emotions, and behavior to reduce this discrepancy. The detection of zero or positive discrepancies, in contrast, reflects goal achievement, whereby efforts will be reduced and goals deactivated (G. A. Miller et al., 1960). In certain cases, goal states represent threats (e.g., avoiding being criticized). Then, self-regulation aims at enlarging the discrepancy between actual and goal states (Carver & Scheier, 1998).

Students are assumed to set goals for their academic performance (Pintrich, 2000; Zimmerman, 2000, 2002; Zimmerman & Moylan, 2009). Those with better self-regulation are expected to achieve higher academic success as efforts are more effectively aligned with goals. In fact, cross-sectional and longitudinal studies found students with better self-regulation, that is, the ability to concentrate and control motor activity and impulsive behaviors, to receive better grades and obtain higher educational attainment overall (de Ridder et al., 2012; Feldmann et al., 1995; Moffitt et al., 2011; Zimmerman, 1990). Similarly, lower self-regulation was associated with poorer academic outcomes and an increased risk of academic failure (Duckworth et al., 2014; McClelland & Cameron, 2011; Polderman et al., 2010).

#### 1.1.1 | Associations of self-regulation and executive functions at the between-person level

Executive functions (EFs) have been identified as key predictors of self-regulation. They denote a range of top-down mental processes needed to organize information, plan, solve problems, and orchestrate cognitions, emotions, and behavior in the service of goal striving, that

is, to self-regulate (Espy, 2004; Miller & Cohen, 2001). EFs encompass cognitive flexibility (i.e., shifting; switching flexibly between tasks), updating (i.e., WM; constant monitoring and rapid addition/deletion of WM contents), and inhibition (e.g., deliberate overriding of dominant responses; e.g., Miyake et al., 2000; St Clair-Thompson & Gathercole, 2006). Self-regulation in more general terms and in learning situations in particular has consistently been shown to be positively associated with EFs (e.g., Mischel et al., 2011; Moffitt et al., 2011; Roebers, 2017; Rutherford et al., 2018). Similarly, impaired EFs, such as in the case of attention-deficit/hyperactivity disorder (ADHD), have been associated with self-regulation difficulties (e.g., Barkley, 2013; Diamond, 2005; Gathercole et al., 2006).

As for the particular role of WM for self-regulation, several mechanisms have been proposed (Hofmann et al., 2012). First, through the *active representation* of goal-relevant information (e.g., goal standards; e.g., Hofmann et al., 2012; Shah et al., 2002; Smith & Jonides, 1999), WM supports the continuous comparison between actual and desired goal states (Baumeister & Heatherton, 1996; Carver & Scheier, 1998). Additionally, through its involvement in the *top-down regulation of attention* away from tempting and towards goal-relevant stimuli (Ilkowska & Engle, 2010; Kane et al., 2001), it supports in *shielding* self-regulatory goals from competing matters (Shah et al., 2002). Finally, WM assists self-regulation as it supports the *monitoring* of goal progress and *updating* of mental goal representations and the means selected for goal striving (Baumeister & Heatherton, 1996; Smith & Jonides, 1999). Better WM should thus be associated with better self-regulation and hence with an increased probability to achieve set goals. However, the role of WM for children's self-regulation has hardly been examined.

Among EFs, particularly WM has most consistently been shown to be associated with student academic outcomes. Children with better WM were shown to obtain higher academic attainment overall (Lechuga et al., 2014; Lehto, 2006). Additionally, WM was shown to be associated with academic achievement in mathematics (e.g., Bull & Scerif, 2001; Friso-Van Den Bos et al., 2013; Oberer et al., 2018) and reading comprehension performance (e.g., Carretti et al., 2009; Cornoldi et al., 2012; Oberer et al., 2018), underscoring the assumption that WM is crucially involved in key scholastic abilities.

In summary, existing empirical evidence and theoretical considerations suggest that self-regulation and WM are positively associated and that both are predictive of students' academic success. To derive these insights, studies mainly relied on data collected cross-sectionally or longitudinally with only single measurements per period (e.g., Duckworth et al., 2014, 2019; Rutherford et al., 2018). These data thereby only licensed conclusions about associations at the between-person level (Molenaar & Campbell, 2009).

### 1.1.2 | Associations of self-regulation and WM at the within-person level

Information about associations at the within-person level, in addition to the between-person level, is important in the school context. Such information can help to identify potential targets for supporting daily academic performance and inform effective individualized support measures tailored to students' momentary learning requirements (i.e., adaptive teaching; Corno, 2008; Randi & Corno, 2005; Tetzlaff et al., 2021). As findings at the between-person level usually cannot easily be translated to the within-person level and associations at both levels may differ and even be opposing (e.g., Molenaar & Campbell, 2009; Wang & Maxwell, 2015), research at both between- and within-person levels is highly warranted (e.g., Curran & Bauer, 2010).

A growing body of recent research has indeed collected data from individuals at high frequency (e.g., daily), over longer time periods (i.e., intensive longitudinal data), and in real life (i.e., ambulatory assessment; Fahrenberg et al., 2007). When analyzed using multilevel models, these data allowed for both between- and within-person level inferences to be derived. Such studies showed self-regulation to vary both between and within individuals (e.g., from day to day, e.g., Ludwig et al., 2016; Schmid et al., 2020). Similarly, considering daily assessments with adults, WM was found to vary at both levels (e.g., Brose et al., 2010; Riediger et al., 2014; Schmiedek et al., 2013). The few studies considering children's and adolescents' daily WM also demonstrated it to vary within and between individuals (Dirk & Schmiedek, 2016; Galeano-Keiner et al., 2022; Gasimova et al., 2014; Riediger et al., 2011, 2014). For example, the amount of total variance in WM explained through variation at the within-person level ranged from 57% to 68% for spatial WM and from 46% to 62% for numeric WM (Dirk & Schmiedek, 2016).

Studies additionally demonstrated negative associations between variations in children's daily WM and academic achievement in mathematics and German (i.e., mother tongue; Dirk & Schmiedek, 2016) and between daily WM span and mathematics grades 3 years later (Judd et al., 2021), corroborating the notion that students' daily WM should be considered a central determinant of general school outcomes (Lechuga et al., 2014).

While substantial between-person level research considered associations between self-regulation, WM, and academic outcomes, to our knowledge, no study investigated links at the within-person level between students' daily self-regulation, WM, perceived academic success, and general academic outcomes. It also remains to be clarified whether students' daily WM and self-regulation independently contribute to daily and general academic success. Finally, while most between-person studies suggested EFs and WM to underpin self-regulation, it is yet to be investigated whether daily self-regulation underpins daily WM.

## 1.2 | Achievement goal orientations

Between-person differences in achievement goals, which are considered to reflect the rationale behind students' motivation to achieve these goals, have also been shown to explain differences in academic outcomes (e.g., Dweck, 1999; Elliot & Harackiewicz, 1994; Elliot & McGregor, 2001; Huang, 2012). Along the trichotomous model of achievement goals, the latter can be classified as mastery goals, performance-avoidance goals, and performance-approach

goals (Elliot & Harackiewicz, 1996). The further distinction between mastery-approach and mastery-avoidance goals (i.e., goals reflecting the aim to not lose competence or skills) has been proposed in the 2 × 2 framework of achievement goal orientations (Elliot & McGregor, 2001). While recent research, however, found students to only rarely report mastery-avoidance goals (M. Lee & Bong, 2016), only mastery-approach goals, henceforth termed mastery goals, will be considered in the present investigation.

*Mastery goals* reflecting a focus on increasing competence were shown to be conducive to student achievement (Huang, 2012; Scherrer et al., 2020; Schwinger et al., 2016). *Performance-avoidance goals* reflecting the motivation to avoid failure and giving the impression of being incompetent (i.e., negative feedback loop) were shown to be detrimental to learning (Huang, 2012; Payne et al., 2007; Scherrer et al., 2020). Finally, mixed evidence has been presented as to *performance-approach goals* reflecting the motivation to outperform others and to demonstrate competence: While positive associations with educational outcomes have been presented (Huang, 2012), substantial evidence also demonstrated them to be unrelated or negatively related with academic outcomes (Midgley et al., 2001; Payne et al., 2007; Scherrer et al., 2020). So far, research on achievement goals largely considered individual preferences for different goals as stable dispositions (i.e., between- rather than within-person differences), only changing over long time periods (Anderman & Midgley, 1997; Spinath & Spinath, 2005).

### 1.2.1 | Associations of achievement goal orientations and self-regulation at the between-person level

Between-person differences in achievement goal orientations were furthermore suggested to explain self-regulation differences. Particularly mastery goals were considered to promote self-regulation (Kanfer, 1990; Payne et al., 2007; Pintrich, 2000): They are assumed to bring the learning content into the goal focus, thereby guiding students' attention to learning materials, fostering high efforts and engagement, and supporting monitoring of the learning process (e.g., Ames & Archer, 1988; Elliot, 1999; Lee et al., 2021). Efforts to achieve mastery goals should thus be guided to ensure, increase, or accelerate learning, for instance by increasing concentration and applying efficient learning strategies (e.g., Carver & Scheier, 1998; Harackiewicz & Linnenbrink, 2005; Lee et al., 2021). Moreover, mastery goals were considered to promote self-regulation as students set more difficult goals for themselves, which did not apply for performance goals (Horvath et al., 2006; Payne et al., 2007). More difficult goals were shown to support behavioral self-regulation (e.g., Locke & Latham, 1990).

In contrast, neither performance-approach nor performance-avoidance goals were considered to promote student self-regulation (Lee et al., 2021; Payne et al., 2007; Pintrich, 2000). Performance goals should generally be assumed to bring other people's impression of one's own competence into the goal focus (Dweck & Leggett, 1988). The investment of efforts into mastering academic tasks might thus be understood to signal low ability to others. Performance goals were therefore assumed to lead to reduced efforts to accomplish academic tasks (i.e., lower self-regulation) to avoid giving this impression (Pintrich, 2000). As such, performance goals have also been found to be associated with superficial processing and disorganizing tendencies (e.g., procrastination; Elliot, 1999) and with ineffective learning strategies (Harackiewicz & Linnenbrink, 2005; Pintrich, 2000). Moreover, performance goals were shown to lead students to set easier goals for themselves (Nicholls, 1984), thereby promoting the demonstration of competence. Easier goals were, however, shown to reduce self-regulation by signalling that low efforts should suffice (Locke & Bryan, 1968; Locke & Latham, 1990). Nevertheless, performance-approach goals were also discussed to have the potential to be conducive to self-regulation, as trying to best others should be associated with comparably high efforts and thus better self-regulation (Pintrich, 2000).

### 1.2.2 | Associations of achievement goal orientations and WM at the between-person level

Few studies, however, have addressed the question of how achievement goals relate to WM. Existing evidence largely supported the assumption that mastery goals should be conducive and performance goals detrimental to WM (Avery & Smillie, 2013; Lee et al., 2014; Linnenbrink et al., 1999). Lee and colleagues (2014) provided further support for the assumption that the effect of achievement goals on students' mathematics performance is mediated via WM. These findings have been discussed against the background that increased task interest coincides with mastery goals, but not performance goals. Increased task interest was in turn associated with greater willingness to invest cognitive resources to tasks (Hidi & Harackiewicz, 2000; Hulleman et al., 2008; Lee et al., 2014). Overall, these findings complement evidence demonstrating that mastery goals should be more beneficial to students' cognitive functioning, and thus also their WM, than performance goals (e.g., Escribe & Huet, 2005; Winters & Latham, 1996).

### 1.2.3 | Associations of achievement goal orientations with self-regulation and WM at the within-person level

Several investigations noted that achievement goals might be conceptualized as situational state characteristics, varying on a day-to-day (Goetz et al., 2016; Neubauer et al., 2022) and within-day basis (e.g., lesson to lesson; Martin et al., 2020), besides relatively stable dispositions (Button et al., 1996; Payne et al., 2007). Indeed, Neubauer and colleagues (2022) provided first evidence that daily mastery goals, but neither performance-approach nor performance-avoidance goals, were associated with students' daily perceived academic success at the within-person level. Moreover, aggregated mean values of

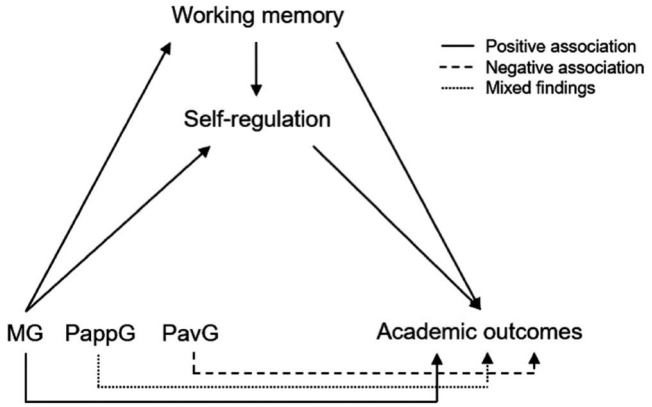


**FIGURE 1** Associations of self-regulation, WM, achievement goals, and academic outcomes at the between-person level. *Note*. MG = Mastery goals, PappG = Performance-approach goals, PavG = Performance-avoidance goals

daily mastery goals were shown to benefit report card grades, while performance-approach goals were unbeneficial, and performance-avoidance goals unrelated (Neubauer et al., 2022).

Further research examining whether day-to-day differences in students' achievement goal orientations are also associated with variations in self-regulation and WM is required. Additionally, it is yet to be investigated whether daily self-regulation and WM are associated with daily perceived academic success beyond the influence of achievement goals. Finally, while between-person evidence indicated self-regulation and WM to not predict any type of achievement goal orientation (Dweck, 1986; Heitz et al., 2008; Vandewalle et al., 2019), it is to be examined whether this applies at the within-person level.

### 1.3 | The present study

The literature reviewed above supported the idea that students' *self-regulation*, *WM*, certain *achievement goal orientations*, and *academic success* are interrelated at the between-person level (for a graphical summary, see Figure 1). However, whether these interrelations are also evident at the within-person level is yet to be determined and therefore is at the core of the present work.

To address these questions, the present study used data from two studies collected in the school context using ambulatory assessments (Fahrenberg et al., 2007; Fahrenberg & Myrtek, 1996). The first study obtained data from primary school students aged between 9 and 11 years directly before their transition to secondary school; the second one collected data from students aged between 9 and 11 years directly after their transition to secondary school. Students reported about their self-regulation, achievement goal orientations, and perceived academic success on a daily basis. Additionally, they completed two WM updating tasks at school each day. Their report card grades as general indicators of academic success were also obtained.

In particular, the following hypotheses were derived from prior evidence mainly considering between-person findings (see Figure 1):

H1a: Self-regulation, WM performance, and mastery goals positively predict academic success on a daily level, while performance-approach goals are unrelated, and performance-avoidance goals negatively related. That is, on days students report higher self-regulation and mastery goals, lower performance-avoidance goals, and show higher WM performance than they usually do, they also report higher perceived academic success.

H1b: Self-regulation, WM performance, and mastery goals negatively predict, performance-approach goals do not predict, and performance-avoidance goals positively predict report card grades (i.e., lower grades indicate better results). That is, students with higher average self-regulation, WM performance, and mastery goals receive lower (i.e., better) report card grades. Students with higher performance-avoidance goals receive higher (i.e., worse) report card grades, while performance-approach goals are irrelevant for report card grades.

H2: WM performance and mastery goals positively predict self-regulation on a daily level, but neither performance-approach nor performance-avoidance goals do. That is, on days students demonstrate higher WM performance and report higher mastery goals than they usually do, they also report higher self-regulation.

H3: Mastery goals positively predict WM performance on a daily level, but neither performance-approach nor performance-avoidance goals do. That is, on days students report higher mastery goals than they usually do, they also show better WM performance.

The same patterns of associations are assumed to apply at the within-person level. Exploratorily, we examined whether average and daily self-regulation and WM performance would predict average and daily (i) mastery, (ii) performance-approach, and (iii) performance-avoidance goals. Additionally, we investigated whether (iv) self-regulation would predict WM performance on average and on a daily level. Results are presented in the Supplement (p. 15ff., Tables S5-S12).

## 2 | METHODS

### 2.1 | Sample

The data analyzed for the present work were collected within the project SASCHA (Social and Academic School transition CHAllenges). At its core, SASCHA aimed to examine social and academic challenges children experience when transitioning from primary to secondary school (i.e., in Germany typically between 9 and 11 years). The project comprised two studies, one directly before (i.e., Grade 4, Study 1) and one directly after the transition to Gymnasium (i.e., academic track of secondary school; Grade 5, Study 2), each comprising a 4-week ambulatory assessment phase. Study 2 also included a follow-up one year from the ambulatory assessment phase.

The sample in Study 1 comprised 90 children (41 boys, 45.56%) aged between 9 and 11 years ($M_{age}$ = 9.83, $SD_{age}$ = 0.50). The sample in Study 2 comprised 108 children (60 boys, 55.56%) aged between 9 and 11 years ($M_{age}$ = 10.11, $SD_{age}$ = 0.44). Four children participating in Study 1 also participated in Study 2. The samples were convenience samples; children were recruited through research assistants

advertising the project to children, teachers, and parents in primary and secondary schools. Participants in both studies were reimbursed for participation with vouchers up to 40 Euro (depending on the number of completed daily assessments). Recruitment in schools was approved by the Hessian Ministry of Education and Cultural Affairs. The Ethics Committee of the German Society for Psychology (DGPs) approved the study. Written informed consent for study participation was obtained from participating children and parents or legal guardians.

## 2.2 | Procedure

All participants attended an introductory session prior to the start of the study. Research assistants instructed them how to operate the smartphones, respond to items, and perform the WM tasks. For the ambulatory assessments, children were equipped with specifically programmed smartphones (only function: research app). During the 4-week phase, children were prompted through the smartphones four times per day: before school, during school, in the afternoon, and in the evening. Children could access items and tasks during specified time windows. Whether children responded, how many items they answered, and whether they performed the WM tasks was up to them. Since the measures relevant for the present work were obtained on schooldays, only those assessments were considered. In Study 1, of 1,664 possible data points (1,620 for morning sessions), 1,138, 1,238, and 1,159 data points were obtained before and during school, and in the evening, corresponding to compliance rates of 70.25%, 74.40%, and 69.65%, respectively. In Study 2, of 2,160 possible data points per assessment, 1,835, 1,867, and 1,687 data points were obtained before and during school, and in the evening, corresponding to compliance rates of 84.97%, 86.42%, and 78.10%, respectively. For further details on the recruitment and study procedure see https://osf.io/yvfpj.

## 2.3 | Measures

### Achievement goal orientations

Children's daily achievement goals were assessed before school, using three items, one for each orientation (i.e., 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 others"; performance-avoidance: "Today, it is important to me to avoid performing poorly compared to my classmates"). Children answered on a 5-point Likert scale ranging from 1 (*not at all true*) to 5 (*completely true*). All items were derived from earlier work by Goetz and colleagues (2016).

### Self-regulation

Children's self-reported concentration as an indicator of current behavioral self-regulation was assessed during school (last 10 min of a lesson; Study 1: 9:30 or 10:15 a.m., Study 2: 9:50 a.m.) using one item, "I am concentrating right now". Children answered on a 5-point Likert scale ranging from 1 (*not at all true*) to 5 (*completely true*). The item was derived from work by Leonhardt and colleagues (2016).

### WM

Children's daily WM was assessed during school (i.e., Study 1: 9:30 or 10:15 a.m., Study 2: 9:50 a.m.) using two WM updating tasks. Children first performed a numerical task, followed by a spatial task (for initial descriptions, see Dirk & Schmiedek, 2016). In the numerical task, two different conditions were completed consecutively (i.e., Loads 3 and 4). Children were presented with three (or four) single-digit numbers between 0 and 9, located in three (or four) fields arranged horizontally next to each other on the smartphone screen. Numbers were presented for 3,000 ms simultaneously in the fields. After an interstimulus interval (ISI) of 250 ms, a number ranging between 0 and 2 and an arithmetic operator (i.e., minus or plus) was presented in one of the three (or four) fields, indicating the calculation children should carry out. Presentation time was 1,500 ms. Subsequently, with the same ISIs and presentation times, three (or four) additional numbers and operators were presented in each of the fields. No number-operator pair was presented in the same field twice in a row. Correct results of the calculations were always positive and $\leq 9$. At the end of each trial, within 20,000 ms, children were asked to enter the final result of the calculations in each field. Children completed four trials in each condition (i.e., Load 3, Load 4) and thus could enter up to 28 responses per measurement, 12 for Load 3 and 16 for Load 4. Accuracy scores indicating the numeric WM performance were calculated by averaging the number of correct responses across all trials, irrespective of condition. Accuracy scores were calculated when children had provided the result for at least one field per trial.

In the spatial task, for which children also worked on two conditions consecutively (i.e., Loads 2 and 3), children were presented with two (or three) differently colored and shaped cartoon creatures located in different fields of a $4 \times 4$ grid. The creatures were presented for 3,000 ms simultaneously. After an ISI of 250 ms, three (or four) arrows corresponding to the color of one of the creatures were presented in the center of the grid, indicating movements of the respective creature to an adjacent location. Presentation time of the arrows was 1,500 ms. No arrow of the same color was presented twice in a row. At the end of each trial, within 20,000 ms, children were asked to indicate the final locations resulting from mentally moving the creatures in the grid. Children completed four trials per condition, and thus could indicate up to 20 locations per measurement, eight for Load 2 and twelve for Load 3. Accuracy scores indicating the spatial WM performance were calculated by averaging the number of correct responses across all trials, irrespective of condition. Accuracy scores were calculated when children had provided the result for at least one creature per trial.

A multilevel confirmatory factor analysis confirmed adequate model fit and significant factor loadings on one factor for both studies (see Supplement, Table S13). Mean average accuracy scores across both

tasks indicated WM performance. Reliability, estimated as multilevel McDonald's $\omega$ (Geldhof et al., 2014), was acceptable at the between- and comparably low at the within-person level for Study 1 (between: $\omega = 0.802$; within: $\omega = 0.516$) and acceptable for Study 2 (between: $\omega = 0.811$; within: $\omega = 0.602$).

### Academic success

Children's perceived daily academic success was assessed with three items presented in the evening: "Today I managed to do something well in class", "Today I solved a difficult task in class", "Today I was successful in class, even with difficult things". Children indicated their answers on a 5-point Likert scale from 1 (*not at all true*) to 5 (*completely true*). Mean values across all items were used as an index of daily perceived academic success. A multilevel confirmatory factor analysis confirmed significant factor loadings of the three items on one factor for both studies (see Supplement, Table S14). Reliability, estimated as multilevel McDonald's $\omega$ (Geldhof et al., 2014) was good for both Study 1 (between: $\omega = .994$; within: $\omega = .820$) and Study 2 (between: $\omega = .978$; within: $\omega = .806$; Neubauer et al., 2022).

### Report card grades

Children's report card grades were assessed as their average grades in mathematics, German (i.e., mother tongue), and English (i.e., first foreign language). Parents and children reported expected report card grades at the end of Grade 4 and final report card grades at the end of Grade 5. Prior grades were assessed as the mid-year report card grades and the final report card grades in Grade 4.

## 2.4 | Data analysis

To test our hypotheses considering the between- and the within-person level (i.e., H1a, H2, H3) we used dynamic structural equation modelling (DSEM; Asparouhov et al., 2017; Hamaker et al., 2018) in M*plus* version 8.4 (Muthén & Muthén, 2019). DSEM combines multilevel modelling to consider our nested data structure with daily assessments (Level 1) nested within children (Level 2) and time-series modelling to consider autoregressive effects. To test Hypothesis H1b, linear regression models were calculated. A Bayesian estimator was used for all DSEM and linear regression models and M*plus*' default (diffuse) priors were used. For all models, two Markov Chain Monte Carlo (MCMC) chains were employed with a 50% burn-in, 3,000 iterations, and a thinning factor of five. The two chains were considered to converge successfully with potential scale reductions < 1.05. Additionally, trace plots and autocorrelation plots of the estimates were each visually inspected to determine whether they indicated convergence. Missing data were imputed using multiple imputation (Asparouhov & Muthén, 2010).

In DSEM, observed data are decomposed into between- and within-person components. Variables assessed at the daily level were centered on person means, thereby reflecting daily deviations from the individual mean (i.e., time-varying predictors). Individual mean scores over the study period were centered on grand means, thereby reflecting deviations from the group mean (i.e., time-invariant predictors). The effects of time-varying predictors are therefore estimates of pure within-person effects and the effects of time-invariant predictors are estimates of pure between-person effects (Wang & Maxwell, 2015). Age, gender, the level of the outcome variable on day *d*-1 (i.e., autoregressive effect), and five dummy-coded variables reflecting children's class membership in one of six classes (i.e., fixed-effects approach) were controlled for in all analyses. Data from Studies 1 and 2 were analyzed separately.

To test Hypothesis H1a, we estimated models with daily perceived academic success as the dependent variable. In stepwise fashion, we first estimated the unique contribution of the covariates, daily concentration, WM, and achievement goals, followed by a full model including all predictors. To test Hypothesis H1b, we estimated a model with final report card grades as the dependent variable. We first estimated the unique contribution of each of the covariates (i.e., age, gender, prior grades, class membership), average self-regulation, WM, and achievement goals over the study period, followed by a full model including all predictors. All predictors except for gender and class membership were z-standardized. To test Hypothesis H2, we estimated models with daily self-regulation as the dependent variable. First, unique contributions of the covariates, daily WM, and achievement goals were considered. Finally, a full model including all predictors was estimated. To test Hypothesis H3, models with daily WM as the dependent variable were estimated. Unique contributions of covariates and daily achievement goals were considered first, followed by a full model including all predictors. Random effects for time-varying predictors were estimated as were covariances among random effects.

The estimates given are the medians of the resulting posterior parameter distributions with the associated 95% credible intervals. Standardized estimates are reported throughout the manuscript. Unstandardized estimates are presented in the Supplement (Tables S1-S4). Parameters whose 95% credible interval did not contain zero were considered statistically significantly different from zero. $R^2$ was calculated as an effect size estimate in relation to the variance explained at both the between- and the within-person level. Data, analysis codes, and M*plus* output files can be found on this work's OSF repository, https://osf.io/p2ws5.

## 3 | RESULTS

Table 1 presents the descriptive statistics and intercorrelations of variables of interest for both Study 1 and Study 2. Decomposing the variance using intra-class correlation showed substantial within-person variability in daily self-regulation, WM, achievement goals, and perceived academic success in both studies. At the between- and within-person level, all achievement goals were positively associated

**TABLE 1** Descriptive statistics, ICC, and level-specific bivariate correlations (Study 1/ Study 2)

| | *M* | *SD or n (%)* | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 Academic success | 3.86/3.95 | 1.34/1.18 | – | **.28/.21** | .01/**.07** | **.27/.35** | **.19/.08** | **.27/.17** | – | – |
| 2 Self-regulation | 3.93/3.68 | 1.44/1.46 | **.58/.66** | – | .04/**.04** | **.23/.22** | **.07/.06** | **.15/.12** | – | – |
| 3 WM[a] | 0.60/0.66 | 0.23/0.22 | **.32**/.19 | .07/.06 | – | .02/**.08** | <.01/.03 | .04/.03 | – | – |
| 4 Mastery goals | 3.95/4.16 | 1.36/1.18 | **.80/.80** | **.64/.65** | .17/.17 | – | **.39/.36** | **.41/.43** | – | – |
| 5 Performance-approach goals | 3.10/3.27 | 1.63/1.49 | **.58/.46** | **.36/.34** | –.03/–.17 | **.54/.56** | – | **.43/.46** | – | – |
| 6 Performance-avoidance goals | 3.65/ 3.79 | 1.54/1.40 | **.65/.59** | **.36/.46** | .07/–.07 | **.53/.76** | **.73/.72** | – | – | – |
| 7 Report card grades[b,c] | 2.09/2.44 | 0.67/0.67 | **–.35/–.21** | –.06/<.01 | **–.67/–.49** | –.18/–.13 | **–.10/.21** | –.02/.03 | – | – |
| 8 Gender[d] | M: 41, F: 49/ M: 60, F: 48 | M: 45.56, F: 54.44/ M: 55.56, F: 44.44 | .08/.05 | .12/–.07 | .14/**.25** | .04/–.06 | .06/–.09 | .09/–.14 | –.14/–.11 | – |
| 9 Age | 9.83/10.11 | 0.50/0.44 | **–.23**/.07 | –.20/.09 | **–.34**/.03 | –.13/.07 | –.04/.10 | –.11/.10 | .21/.11 | **–.28**/–.03 |
| ICC | – | – | .47/.40 | .40/.39 | .52/.40 | .47/.40 | .51/.45 | .50/.42 | – | – |

*Note*. Estimates below the diagonal: between-person level, estimates above the diagonal: within-person level. Study 1: $N = 90$. Study 2: $N = 108$.

[a] $n = 107$ (Study 2).

[b] $n = 72$ (Study 1).

[c] $n = 80$ (Study 2).

[d] female = 0, male = 1.

Abbreviations: M, male; F, female; ICC, intra-class correlation.

Report card grades reflect the German grading system: 1 = best grade, 6 = worst grade.

Values with $p < .05$ are marked bold.

with each other, indicating that individuals setting higher achievement goals did so for all goals. The patterns of associations were comparable for both studies. Additionally, males showed better WM performance than females in Study 2. Moreover, age was significantly negatively correlated with WM in Study 1, indicating that younger children showed better WM performance.

### 3.1 | Associations of self-regulation, WM, and achievement goals with perceived academic success (H1a)

For Study 1, results of stepwise DSEMs (Table 2) indicated perceived academic success on day *d*-1 to be consistently significantly positively associated with perceived academic success on day *d*, while associations with age and gender were not statistically meaningful. Positive associations with self-regulation were significant both at the between- and the within-person level in a model additionally only considering covariates (Model 2, Table 2). In the full model, positive associations with self-regulation were significant only at the within-person level (Full Model, Table 2). Positive associations with WM performance were significant only at the between-person, but not the within-person level in both a model additionally considering covariates (Model 3, Table 2) and the full model. Positive associations with mastery goals and performance-avoidance goals were significant both at the between- and the within-person level, while associations with performance-approach goals were not statistically meaningful (Model 4, Table 2). This pattern of associations remained largely consistent in the full model, while associations with mastery goals and performance-avoidance goals became statistically insignificant and associations with performance-avoidance goals significant at the within-person level.

For Study 2, the pattern of associations in relation to covariates was largely identical (Table 2). Positive associations with self-regulation at both the between- and the within-person level were evident in the model additionally only considering covariates (Model 2, Table 2) and the full model. Associations with WM performance were statistically insignificant at both levels and in both a model additionally only considering covariates (Model 3, Table 2) and the full model. As for associations with achievement goals, only positive associations with mastery goals reached statistical significance at both the between- and the within-person level (Model 4, Full Model, Table 2).

### 3.2 | Associations of average self-regulation, WM, and achievement goals with report card grades (H1b)

For Study 1, stepwise linear regression models indicated prior grades to be consistently significantly positively associated with report card grades (Table 3). Additionally, age was significantly negatively associated with report card grades when WM performance was additionally considered (Model 3, Full Model, Table 3), indicating that older children obtained better, that is lower, grades. Associations with gender were insignificant. WM performance was significantly negatively associated with report card grades in both a model additionally only considering covariates and the full model, indicating that children with better WM obtained better, that is lower, grades (Model 3, Full Model, Table 3). Associations with self-regulation and achievement goals were not statistically meaningful (Model 2, Model 4, Full Model, Table 3).

Results obtained in relation to Study 2 were comparable. Prior grades were consistently significantly positively associated, while associations with age and gender were not statistically meaningful (Table 3). WM performance was significantly negatively associated in both a model additionally only considering covariates and the full model (Model 3, Full Model, Table 3). Associations with self-regulation were not statistically meaningful (Model 2, Full Model, Table 3). As for associations with achievement goals, mastery goals were negatively and performance-approach goals positively associated with report card grades in a model additionally only considering covariates, indicating that children who set higher mastery and lower performance-approach goals obtained better, that is lower, grades (Model 4, Table 3). In the full model, associations were nonsignificant, however (Full Model, Table 3).

### 3.3 | Associations of WM and achievement goals with self-regulation (H2)

For Study 1, results of stepwise DSEMs (Table 4) indicated self-regulation on day *d*-1 to be consistently significantly positively associated with self-regulation on day *d*, while associations with age and gender were not statistically meaningful. Associations with WM were not statistically meaningful, neither at the between-person nor the within-person level, and neither in a model additionally only including covariates nor the full model (Model 2, Full Model, Table 4). Mastery goals were significantly positively associated with daily self-regulation both at the between-person and the within-person level in both the model additionally only including covariates and the full model (Model 3, Full Model, Table 4). Associations with performance-approach and performance-avoidance goals at both the between- and the within-person level did not reach statistical significance.

For Study 2, the pattern of associations in relation to covariates was identical (Table 4). Additionally, associations with WM were not statistically meaningful (Model 2, Full Model, Table 4). As for associations with achievement goals, positive associations with mastery goals reached statistical significance at both the within- and between-person level in both a model additionally considering only covariates and the full model (Model 3, Full Model, Table 4). Associations with performance-approach and performance-avoidance goals did not reach statistical significance, neither at the between- nor the within-person level.

### 3.4 | Associations of achievement goals with WM performance (H3)

For Study 1, results of stepwise DSEMs (Table 5) indicated WM on day *d*-1 to be consistently positively associated with WM on day *d*.

**TABLE 2** DSEMs predicting daily perceived academic success (Study 1/ Study 2)

| | Null Model | | | Model 1 | | | Model 2 | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 95% CI | | | 95% CI | | | 95% CI | |
| | *Est.* | *LL* | *UL* | *Est.* | *LL* | *UL* | *Est.* | *LL* | *UL* |
| Intercept | **4.03/5.16** | 3.33/4.39 | 4.76/6.01 | **3.84/4.79** | 2.96/3.77 | 4.80/5.92 | **4.19/4.66** | 3.34/3.79 | 5.07/5.59 |
| Class Membership (1) | – | – | – | −0.003/−0.02 | −0.18/−0.20 | 0.19/0.14 | −0.02/−0.02 | −0.15/−0.15 | 0.12/0.12 |
| Class Membership (2) | – | – | – | −0.02/0.01 | −0.19/−0.16 | 0.16/0.19 | 0.03/0.02 | −0.11/−0.12 | 0.16/0.16 |
| Class Membership (3) | – | – | – | −0.09/−0.02 | −0.27/−0.20 | 0.10/0.16 | 0.001/0.03 | −0.15/−0.11 | 0.13/0.17 |
| Class Membership (4) | – | – | – | 0.03/−0.01 | −0.16/−0.18 | 0.22/0.16 | −0.06/0.02 | −0.19/−0.12 | 0.08/0.15 |
| Class Membership (5) | – | – | – | 0.06/−0.04 | −0.12/−0.22 | 0.25/0.15 | 0.06/0.003 | −0.09/−0.14 | 0.20/0.14 |
| Age | – | – | – | −0.19/0.06 | −0.41/−0.13 | 0.03/0.26 | −0.14/0.02 | −0.32/−0.14 | 0.03/0.18 |
| Gender | – | – | – | 0.08/0.04 | −0.15/−0.17 | 0.32/0.24 | 0.08/0.09 | −0.09/−0.07 | 0.27/0.24 |
| Academic Success *d*-1 | – | – | – | **0.30/0.31** | 0.22/0.24 | 0.37/0.37 | **0.28/0.28** | 0.20/0.22 | 0.36/0.34 |
| Self-Regulation (BP) | – | – | – | – | – | – | **0.73/0.69** | 0.56/0.55 | 0.86/0.80 |
| Self-Regulation (WP) | – | – | – | – | – | – | **0.15/0.12** | 0.07/0.06 | 0.23/0.17 |
| WM (BP) | – | – | – | – | – | – | – | – | – |
| WM (WP) | – | – | – | – | – | – | – | – | – |
| Mastery Goals (BP) | – | – | – | – | – | – | – | – | – |
| Mastery Goals (WP) | – | – | – | – | – | – | – | – | – |
| Performance-Approach Goals (BP) | – | – | – | – | – | – | – | – | – |
| Performance-Approach Goals (WP) | – | – | – | – | – | – | – | – | – |
| Performance-Avoidance Goals (BP) | – | – | – | – | – | – | – | – | – |
| Performance-Avoidance Goals (WP) | – | – | – | – | – | – | – | – | – |
| $R^2$ (within) | – | | | 16.40%/17.60% | | | 27.40%/20.10% | | |
| $R^2$ (between) | – | | | 11.90%/6.10% | | | 61.60%/52.50% | | |

(Continues)

**TABLE 2** (Continued)

| | Model 3 | | | Model 4 | | | Full Model | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 95% CI | | | 95% CI | | | 95% CI | |
| | *Est.* | *LL* | *UL* | *Est.* | *LL* | *UL* | *Est.* | *LL* | *UL* |
| Intercept | **3.86/4.65** | 3.06/3.68 | 4.67/5.66 | **4.05/4.03** | 3.30/3.24 | 4.88/4.99 | **4.42/4.60** | 3.64/3.63 | 5.23/5.69 |
| Class Membership (1) | −0.11/−0.02 | −0.28/−0.18 | 0.09/0.14 | −0.02/0.06 | −0.13/−0.04 | 0.10/0.15 | −0.09/0.04 | −0.20/−0.07 | 0.03/0.14 |
| Class Membership (2) | −0.02/0.04 | −0.18/−0.15 | 0.15/0.20 | 0.04/0.09 | −0.08/−0.01 | 0.15/0.18 | 0.08/0.09 | −0.04/−0.03 | 0.18/0.19 |
| Class Membership (3) | −0.14/0.01 | −0.31/−0.17 | 0.05/0.18 | 0.09/**0.12** | −0.03/0.01 | 0.21/0.22 | 0.08/**0.13** | −0.05/0.01 | 0.18/0.24 |
| Class Membership (4) | −0.05/−0.01 | −0.22/−0.18 | 0.14/0.16 | −0.01/0.06 | −0.12/−0.04 | 0.10/0.15 | −0.05/0.05 | −0.16/−0.07 | 0.07/0.15 |
| Class Membership (5) | 0.04/−0.04 | −0.13/−0.22 | 0.22/0.13 | 0.02/0.06 | −0.10/−0.05 | 0.13/0.16 | 0.03/0.06 | −0.08/−0.05 | 0.14/0.17 |
| Age | −0.10/0.06 | −0.32/−0.14 | 0.11/0.26 | −0.10/0.03 | −0.24/−0.10 | 0.04/0.14 | −0.04/0.02 | −0.17/−0.11 | 0.10/0.14 |
| Gender | 0.06/−0.01 | −0.16/−0.21 | 0.28/0.19 | 0.04/0.05 | −0.10/−0.06 | 0.19/0.17 | 0.04/0.05 | −0.09/−0.07 | 0.17/0.18 |
| Academic Success *d*-1 | **0.27/0.30** | 0.19/0.23 | 0.35/0.36 | **0.22/0.16** | 0.13/0.10 | 0.30/0.22 | **0.17/0.14** | 0.09/0.08 | 0.25/0.21 |
| Self-Regulation (BP) | – | – | – | – | – | – | 0.14/**0.26** | −0.03/0.10 | 0.33/0.45 |
| Self-Regulation (WP) | – | – | – | – | – | – | **0.09/0.09** | 0.01/0.03 | 0.17/0.14 |
| WM (BP) | **0.32**/0.18 | 0.06/−0.02 | 0.53/0.37 | – | – | – | **0.31**/0.06 | 0.16/−0.06 | 0.46/0.20 |
| WM (WP) | 0.01/0.02 | −0.06/−0.03 | 0.07/0.07 | – | – | – | −0.02/0.01 | −0.08/−0.04 | 0.04/0.06 |
| Mastery Goals (BP) | – | – | – | **0.79/0.82** | 0.63/0.71 | 0.88/0.89 | **0.68/0.72** | 0.49/0.54 | 0.82/0.84 |
| Mastery Goals (WP) | – | – | – | **0.09/0.23** | 0.01/0.16 | 0.17/0.30 | 0.07/**0.21** | −0.01/0.14 | 0.15/0.27 |
| Performance-Approach Goals (BP) | – | – | – | 0.03/−0.09 | −0.17/−0.26 | 0.26/0.07 | 0.02/−0.08 | −0.18/−0.25 | 0.22/0.11 |
| Performance-Approach Goals (WP) | – | – | – | 0.08/−0.01 | −0.003/−0.07 | 0.15/0.04 | **0.07**/−0.001 | 0.001/−0.06 | 0.15/0.06 |
| Performance-Avoidance Goals (BP) | – | – | – | **0.27**/0.02 | 0.06/−0.18 | 0.48/0.24 | **0.32**/0.05 | 0.11/−0.18 | 0.53/0.31 |
| Performance-Avoidance Goals (WP) | – | – | – | **0.15**/0.06 | 0.06/ < 0.001 | 0.22/0.12 | 0.08/0.05 | −0.001/−0.01 | 0.16/0.11 |
| $R^2$ (within) | 20.50%/19.60% | | | 39.50%/32.00% | | | 52.10%/36.00% | | |
| $R^2$ (between) | 22.10%/10.00% | | | 76.20%/75.90% | | | 76.60%/69.70% | | |

*Note*. Table depicts standardized coefficients. Female = 0, male = 1. Class membership (six classes) represented by *k*-1 dummy-coded variables.
Abbreviations: BP, between-person level; WP, within-person level.
Values with credible intervals not including zero are marked bold.

**TABLE 3** Linear regression models predicting report card grades in grade 4/5 (Study 1/Study 2)

| | Null Model | | | Model 1 | | | Model 2 | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 95% CI | | | 95% CI | | | 95% CI | |
| | *Est.* | *LL* | *UL* | *Est.* | *LL* | *UL* | *Est.* | *LL* | *UL* |
| Intercept | **2.98/3.54** | 2.43/2.95 | 3.55/4.18 | **2.91/3.41** | 2.56/2.63 | 3.27/4.15 | **2.90/3.37** | 2.53/2.59 | 3.26/4.13 |
| Class Membership (1) | – | – | – | 0.04/0.12 | −0.08/−0.12 | 0.16/0.35 | 0.05/0.12 | −0.07/−0.12 | 0.16/0.35 |
| Class Membership (2) | – | – | – | 0.01/0.17 | −0.11/−0.09 | 0.12/0.41 | 0.01/0.17 | −0.10/−0.09 | 0.13/0.42 |
| Class Membership (3) | – | – | – | 0.01/0.09 | −0.10/−0.18 | 0.13/0.36 | 0.01/0.09 | −0.10/−0.18 | 0.13/0.35 |
| Class Membership (4) | – | – | – | 0.09/0.07 | −0.04/−0.21 | 0.21/0.33 | 0.09/0.06 | −0.04/−0.21 | 0.21/0.34 |
| Class Membership (5) | – | – | – | 0.08/−0.02 | −0.04/−0.30 | 0.19/0.23 | 0.08/−0.02 | −0.03/−0.29 | 0.20/0.25 |
| Age | – | – | – | −0.07/0.11 | −0.17/−0.09 | 0.04/0.30 | −0.07/0.10 | −0.16/−0.10 | 0.03/0.29 |
| Gender | – | – | – | 0.02/−0.15 | −0.08/−0.35 | 0.12/0.05 | 0.03/−0.15 | −0.07/−0.34 | 0.12/0.05 |
| Prior grades | – | – | – | **0.93/0.40** | 0.89/0.19 | 0.97/0.56 | **0.94/0.39** | 0.89/0.20 | 0.97/0.56 |
| Self-regulation | – | – | – | – | – | – | 0.03/−0.02 | −0.07/−0.20 | 0.13/0.17 |
| WM | – | – | – | – | – | – | – | – | – |
| Mastery goals | – | – | – | – | – | – | – | – | – |
| Performance-approach goals | – | – | – | – | – | – | – | – | – |
| Performance-avoidance goals | – | – | – | – | – | – | – | – | – |
| $R^2$ | – | | | 84.60%/32.40% | | | 84.50%/32.70% | | |

(Continues)

**TABLE 3** (Continued)

| | Model 3 | | | Model 4 | | | Full Model | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 95% CI | | | 95% CI | | | 95% CI | |
| | *Est.* | *LL* | *UL* | *Est.* | *UL* | *UL* | *Est.* | *UL* | *UL* |
| Intercept | **2.89**/**3.53** | 2.58/2.85 | 3.22/4.21 | **2.86**/**3.54** | 2.50/2.75 | 3.21/4.25 | **2.83**/**3.58** | 2.52/2.90 | 3.16/4.30 |
| Class Membership (1) | 0.11/0.12 | −0.003/−0.09 | 0.22/0.33 | 0.08/0.03 | −0.04/−0.20 | 0.21/0.27 | **0.16**/0.06 | 0.05/−0.15 | 0.28/0.27 |
| Class Membership (2) | −0.01/0.09 | −0.12/−0.14 | 0.09/0.32 | 0.02/0.05 | −0.09/−0.22 | 0.14/0.30 | 0.01/0.02 | −0.10/−0.23 | 0.12/0.24 |
| Class Membership (3) | 0.03/−0.04 | −0.07/−0.27 | 0.14/0.20 | 0.04/−0.10 | −0.08/−0.38 | 0.15/0.18 | 0.07/−0.14 | −0.04/−0.39 | 0.17/0.13 |
| Class Membership (4) | 0.11/0.002 | −0.01/−0.23 | 0.22/0.25 | 0.11/−0.02 | −0.02/−0.28 | 0.23/0.26 | **0.12**/−0.05 | 0.01/−0.30 | 0.23/0.19 |
| Class Membership (5) | 0.06/−0.08 | −0.04/−0.31 | 0.17/0.16 | 0.09/−0.14 | −0.03/−0.39 | 0.20/0.13 | 0.08/−0.15 | −0.03/−0.38 | 0.18/0.09 |
| Age | **−0.10**/0.08 | −0.19/−0.10 | −0.01/0.25 | −0.07/0.04 | −0.16/−0.15 | 0.04/0.23 | **−0.10**/0.05 | −0.18/−0.12 | −0.01/0.22 |
| Gender | <0.001/−0.07 | −0.09/−0.24 | 0.09/0.11 | 0.01/−0.11 | −0.08/−0.29 | 0.11/0.09 | −0.01/−0.07 | −0.09/−0.25 | 0.08/0.12 |
| Prior grades | **0.80**/**0.36** | 0.71/0.18 | 0.89/0.51 | **0.92**/**0.39** | 0.86/0.21 | 0.96/0.55 | **0.78**/**0.35** | 0.68/0.18 | 0.87/0.50 |
| Self-regulation | – | – | – | – | – | – | 0.01/0.10 | −0.11/−0.10 | 0.13/0.30 |
| WM | **−0.23**/**−0.43** | −0.35/−0.57 | −0.11/0.26 | – | – | – | **−0.24**/**−0.35** | −0.37/−0.52 | −0.12/−0.16 |
| Mastery goals | – | – | – | −0.09/**−0.27** | −0.21/−0.53 | 0.03/−0.02 | −0.08/−0.16 | −0.20/−0.44 | 0.05/0.14 |
| Performance-approach goals | – | – | – | 0.01/**0.36** | −0.14/0.08 | 0.14/0.60 | 0.01/0.24 | −0.11/−0.02 | 0.14/0.50 |
| Performance-avoidance goals | – | – | – | 0.11/−0.11 | −0.03/−0.41 | 0.25/0.22 | 0.13/−0.14 | −0.01/−0.43 | 0.26/0.16 |
| $R^2$ | 87.30%/48.70% | | | 85.10%/41.10% | | | 88.10%/51.40% | | |

*Note*. Table depicts standardized coefficients. Female = 0, male = 1. Class membership (six classes) represented by *k*-1 dummy-coded variables. Report card grades reflect the German grading system: 1 = best grade, 6 = worst grade.
Values with credible intervals not including zero are marked bold.

**TABLE 4** DSEMs predicting daily self-regulation (Study 1/Study 2)

| | Null model | | | Model 1 | | | Model 2 | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 95% CI | | | 95% CI | | | 95% CI | |
| | *Est.* | *LL* | *UL* | *Est.* | *LL* | *UL* | *Est.* | *LL* | *UL* |
| Intercept | **4.27/3.94** | 3.52/3.35 | 5.07/4.59 | **3.83/4.04** | 2.88/3.28 | 4.84/4.79 | **3.70/3.97** | 2.78/3.19 | 4.72/4.78 |
| Class Membership (1) | – | – | – | 0.03/−0.07 | −0.15/−0.23 | 0.20/0.11 | 0.03/−0.06 | −0.15/−0.22 | 0.21/0.12 |
| Class Membership (2) | – | – | – | −0.11/−0.09 | −0.29/−0.25 | 0.07/0.11 | −0.10/−0.07 | −0.26/−0.25 | 0.08/0.12 |
| Class Membership (3) | – | – | – | −0.07/−0.10 | −0.25/−0.26 | 0.11/0.10 | −0.07/−0.08 | −0.26/−0.26 | 0.11/0.11 |
| Class Membership (4) | – | – | – | 0.10/−0.07 | −0.10/−0.24 | 0.28/0.13 | 0.10/−0.06 | −0.10/−0.24 | 0.27/0.13 |
| Class Membership (5) | – | – | – | −0.01/−0.13 | −0.21/−0.30 | 0.18/0.06 | −0.01/−0.13 | −0.21/−0.30 | 0.17/0.06 |
| Age | – | – | – | −0.11/0.12 | −0.33/−0.09 | 0.12/0.33 | −0.10/−0.12 | −0.33/−0.10 | 0.12/0.32 |
| Gender | – | – | – | 0.06/−0.05 | −0.17/−0.26 | 0.28/0.16 | 0.07/−0.07 | −0.16/−0.27 | 0.27/0.14 |
| Self-Regulation *d*-1 | – | – | – | **0.28/0.26** | 0.20/0.20 | 0.35/0.32 | **0.28/0.26** | 0.20/0.20 | 0.35/0.31 |
| WM (BP) | – | – | – | – | – | – | −0.02/0.08 | −0.26/−0.13 | 0.23/0.28 |
| WM (WP) | – | – | – | – | – | – | 0.02/0.01 | −0.03/−0.03 | 0.08/0.06 |
| Mastery Goals (BP) | – | – | – | – | – | – | – | – | – |
| Mastery Goals (WP) | – | – | – | – | – | – | – | – | – |
| Performance-Approach Goals (BP) | – | – | – | – | – | – | – | – | – |
| Performance-Approach Goals (WP) | – | – | – | – | – | – | – | – | – |
| Performance-Avoidance Goals (BP) | – | – | – | – | – | – | – | – | – |
| Performance-Avoidance Goals (WP) | – | – | – | – | – | – | – | – | – |
| $R^2$ (within) | – | | | 17.00%/17.20% | | | 18.20%/18.40% | | |
| $R^2$ (between) | – | | | 10.40%/11.00% | | | 11.30%/12.60% | | |

(Continues)

**TABLE 4** (Continued)

| | Model 3 | | | Full Model | | |
|---|---|---|---|---|---|---|
| | | 95% CI | | | 95% CI | |
| | *Est.* | *LL* | *UL* | *Est.* | *LL* | *UL* |
| Intercept | **3.75/3.51** | 2.99/2.69 | 4.62/4.47 | **3.56/3.35** | 2.84/2.52 | 4.37/4.25 |
| Class Membership (1) | 0.02/0.004 | −0.11/−0.14 | 0.14/0.13 | 0.03/0.002 | −0.10/−0.13 | 0.16/0.13 |
| Class Membership (2) | −0.08/−0.03 | −0.20/−0.17 | 0.04/0.11 | −0.08/−0.03 | −0.19/−0.17 | 0.04/0.10 |
| Class Membership (3) | 0.001/0.03 | −0.13/−0.11 | 0.13/0.17 | 0.01/0.02 | −0.12/−0.13 | 0.15/0.16 |
| Class Membership (4) | 0.05/−0.03 | −0.07/−0.17 | 0.18/0.11 | 0.06/−0.03 | −0.07/−0.17 | 0.19/0.10 |
| Class Membership (5) | −0.04/−0.05 | −0.16/−0.19 | 0.09/0.10 | −0.04/−0.04 | −0.17/−0.20 | 0.09/0.09 |
| Age | −0.03/0.08 | −0.18/−0.07 | 0.10/0.23 | −0.06/0.07 | −0.21/−0.08 | 0.10/0.22 |
| Gender | 0.10/−0.06 | −0.05/−0.20 | 0.25/0.09 | 0.08/−0.04 | −0.07/−0.19 | 0.23/0.10 |
| Self-Regulation *d*-1 | **0.30/0.20** | 0.22/0.14 | 0.37/0.26 | **0.28/0.20** | 0.21/0.15 | 0.35/0.26 |
| WM (BP) | – | – | – | −0.09/−0.06 | −0.27/−0.21 | 0.09/0.11 |
| WM (WP) | – | – | – | 0.02/0.01 | −0.03/−0.04 | 0.07/0.05 |
| Mastery Goals (BP) | **0.76/0.70** | 0.58/0.51 | 0.89/0.81 | **0.73/0.71** | 0.56/0.53 | 0.85/0.81 |
| Mastery Goals (WP) | **0.15/0.13** | 0.07/0.07 | 0.23/0.19 | **0.16/0.13** | 0.07/0.07 | 0.24/0.20 |
| Performance-Approach Goals (BP) | <0.001/−0.06 | −0.21/−0.27 | 0.23/0.15 | −0.01/−0.07 | −0.24/−0.28 | 0.23/0.13 |
| Performance-Approach Goals (WP) | −0.02/−0.03 | −0.10/−0.09 | 0.05/0.03 | −0.02/−0.02 | −0.09/−0.09 | 0.06/0.03 |
| Performance-Avoidance Goals (BP) | −0.04/−0.08 | −0.28/−0.30 | 0.23/0.22 | −0.01/−0.09 | −0.25/−0.31 | 0.24/0.17 |
| Performance-Avoidance Goals (WP) | 0.07/0.04 | −0.01/−0.02 | 0.14/0.10 | 0.05/0.03 | −0.03/−0.02 | 0.12/0.09 |
| $R^2$ (within) | 39.20%/26.20% | | | 39.60%/28.60% | | |
| $R^2$ (between) | 66.90%/57.80% | | | 63.60%/59.50% | | |

*Note*. Table depicts standardised coefficients. Female = 0, male = 1. Class membership (six classes) represented by *k*-1 dummy-coded variables.
Abbreviations: BP = between-person level; WP = within-person level.
Values with credible intervals not including zero are marked bold.

**TABLE 5** DSEMs predicting daily working memory (Study 1/Study 2)

| | Null model | | | Model 1 | | | Full Model | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 95% CI | | | 95% CI | | | 95% CI | |
| | *Est.* | *LL* | *UL* | *Est.* | *LL* | *UL* | *Est.* | *LL* | *UL* |
| Intercept | **3.41/4.71** | 2.81/3.99 | 4.02/5.50 | **2.98/4.39** | 2.16/3.59 | 3.90/5.27 | **2.75/3.63** | 2.00/2.76 | 3.55/4.56 |
| Class Membership (1) | – | – | – | **0.27**/−0.05 | 0.10/−0.21 | 0.41/0.12 | **0.23**/0.02 | 0.06/−0.13 | 0.37/0.16 |
| Class Membership (2) | – | – | – | 0.01/−0.12 | −0.17/−0.28 | 0.16/0.05 | 0.01/−0.05 | −0.17/−0.20 | 0.16/0.10 |
| Class Membership (3) | – | – | – | 0.14/−0.15 | −0.04/−0.31 | 0.29/0.03 | 0.11/−0.04 | −0.06/−0.19 | 0.27/0.12 |
| Class Membership (4) | – | – | – | **0.20**/−0.05 | 0.004/−0.21 | 0.35/0.12 | 0.14/−0.003 | −0.04/−0.15 | 0.30/0.14 |
| Class Membership (5) | – | – | – | 0.04/−0.02 | −0.15/−0.18 | 0.20/0.16 | 0.02/0.05 | −0.15/−0.11 | 0.17/0.20 |
| Age | – | – | – | **−0.29**/0.01 | −0.48/−0.18 | −0.08/0.20 | **−0.24**/0.03 | −0.43/−0.13 | −0.03/0.19 |
| Gender | – | – | – | −0.02/**0.26** | −0.22/0.07 | 0.22/0.45 | −0.01/**0.18** | −0.20/0.02 | 0.19/0.35 |
| WM *d*-1 | – | – | – | **0.39/0.18** | 0.31/0.13 | 0.47/0.24 | **0.34/0.15** | 0.27/0.09 | 0.42/0.21 |
| Mastery Goals (BP) | – | – | – | – | – | – | 0.17/**0.44** | −0.06/0.19 | 0.40/0.62 |
| Mastery Goals (WP) | – | – | – | – | – | – | 0.03/0.05 | −0.05/−0.01 | 0.11/0.12 |
| Performance-Approach Goals (BP) | – | – | – | – | – | – | −0.18/−0.21 | −0.43/−0.44 | 0.11/0.03 |
| Performance-Approach Goals (WP) | – | – | – | – | – | – | −0.04/0.02 | −0.12/−0.04 | 0.04/0.08 |
| Performance-Avoidance Goals (BP) | – | – | – | – | – | – | 0.08/−0.21 | −0.22/−0.46 | 0.35/0.10 |
| Performance-Avoidance Goals (WP) | – | – | – | – | – | – | 0.04/−0.02 | −0.04/−0.08 | 0.11/0.05 |
| $R^2$ (within) | – | | | 19.70%/6.70% | | | 29.90%/17.80% | | |
| $R^2$ (between) | – | | | 26.70%/15.70% | | | 30.70%/40.00% | | |

*Note*. Table depicts standardized coefficients. Female = 0, male = 1. Class membership (six classes) represented by *k*-1 dummy-coded variables.
Abbreviations: BP, between-person level; WP, within-person level.
Values with credible intervals not including zero are marked bold.

Additionally, age was significantly negatively associated with WM performance, indicating that older children performed worse. As for associations with achievement goals, none of them were statistically significant, neither at the between-person nor the within-person level (Full Model, Table 5).

Results for Study 2 indicated WM on day *d*-1 to be consistently positively associated with WM on day *d* (Table 5). Additionally, gender, but not age, was positively associated with daily WM performance, indicating that males performed better. As for associations with achievement goals, mastery goals were significantly positively associated with WM performance at the between-person level, while all other associations were not statistically meaningful (Full Model, Table 5).

## 4 | DISCUSSION

The present investigation used data from two studies collected from children aged 9 to 11 across 4 weeks in the school context using ambulatory assessments to examine the interrelations of *self-regulation*, *WM*, *achievement goal orientations*, and their relevance for *academic success* at both the between- and the within-person level. Additionally, associations with *report card grades* were examined. Study 1 collected data from primary school students directly before their transition to secondary school, while Study 2 collected data from secondary school students directly after their transition to an academic track school.

### 4.1 | Variations at the within-person level

Accounting for 60% (Study 1) and 61% (Study 2) of the overall variance, results indicated substantial variation in self-regulation at the within-person level, paralleling earlier evidence (e.g., Ludwig et al., 2016; Schmid et al., 2020). Similarly, WM performance substantially varied within individuals, accounting for 48% (Study 1) and 60% (Study 2) of the total variance, which reflects prior findings (e.g., Dirk & Schmiedek, 2016). Moreover, as has also been demonstrated by Neubauer and colleagues (2022) for data obtained in Study 2, achievement goals varied within individuals, amounting to up to 53% (Study 1) and 60% (Study 2) of the overall variance, thereby paralleling earlier evidence (e.g., Martin et al., 2020).

### 4.2 | Associations of self-regulation, WM, and achievement goals with perceived academic success

The present results only partially supported our expectation that self-regulation, WM performance, and mastery goals should be positively related, performance-approach goals unrelated, and performance-avoidance goals negatively related with daily perceived academic success at the between- and the within-person level. First, consistent with expectations and earlier research considering the between-person perspective (e.g., Dent & Koenka, 2016; Duckworth et al., 2019), results of models considering self-regulation as the only predictor in addition to covariates indicated that primary and secondary school students who reported higher average self-regulation also reported higher daily perceived academic success. However, models additionally considering WM performance and achievement goals could not confirm this finding in relation to primary school students. When additional predictors were considered, primary school students' overall ability to concentrate mattered less for their daily perceived academic success. These findings complement existing between-person level self-regulation research, which has hardly considered the contribution of WM and achievement goals (e.g., Duckworth et al., 2019; Rutherford et al., 2018). Additionally, in accordance with prior research considering the between-person perspective (e.g., Dent & Koenka, 2016; Duckworth et al., 2019), primary and secondary school students reported higher perceived academic success on days they also reported higher self-regulation. The results thereby further suggest the relevance of self-regulation for academic success and extend existing evidence with associations at the within-person level.

Second, partially contrasting earlier findings emphasizing the role of WM for academic achievement (e.g., Bull & Scerif, 2001; Carretti et al., 2009; Lechuga et al., 2014), results of models considering WM as the only predictor in addition to covariates and models additionally considering self-regulation and achievement goals showed that only primary, but not secondary school students with higher average WM performance reported higher daily perceived academic success. Given the robust evidence in relation to the relevance of WM for students' academic outcomes, these results might suggest that students' judgement of their daily success could be different in the beginning of secondary school as compared to in primary school. After having transitioned, children face the challenges of growing into a newly developing class community and adapting to a new school environment with largely unknown demands (e.g., Schmidt et al., 2020). These challenges might temporarily disturb their precise daily performance judgements (e.g., Arens et al., 2013), hence resulting in temporarily reduced associations with WM. Alternatively, earlier findings indicated a drop in student motivation during adaption phases following transitions (e.g., Wigfield et al., 1991), which might similarly explain reduced associations with WM. Additionally, results generally indicated daily WM performance to be unrelated with daily perceived academic success in both student groups. These results might be viewed to suggest that children's daily WM performance is largely irrelevant for their daily perceived academic success. However, given the comparably low reliability of the tasks used to assess daily WM and given that children's motivation to work on the tasks should have substantially influenced their performance, this finding should be interpreted with caution.

Third, in line with expectations and earlier between-person research (e.g., Huang, 2012; Scherrer et al., 2020), models considering only achievement goals in addition to covariates indicated primary and secondary school students reporting higher average mastery goals to also report higher daily perceived academic success. However, models additionally considering self-regulation and WM performance showed only primary, but not secondary school students reporting higher average mastery goals to also report higher daily perceived academic success. Given the robust evidence showing that mastery goals should

be positively associated with student success, these results might again reflect students' altered judgement of their daily academic performance during adaption to secondary school (e.g., Arens et al., 2013), which is reflected in reduced associative strength in comparison to primary school. Alternatively, given that earlier research considering achievement goals rarely considered self-regulation and WM performance, these findings might provide initial clues concerning the role self-regulation and WM might play in the association of mastery goals and academic success.

Additionally, models considering only achievement goals in addition to covariates indicated that days students reported higher than usual mastery goals were days they also reported higher perceived academic success, which is in line with existing between-person level evidence (e.g., Huang, 2012; Scherrer et al., 2020). However, models additionally considering self-regulation and WM performance confirmed this finding only for secondary school students, hence contrasting prior research. This finding might reflect the notion that daily mastery goals should be particularly relevant in self-regulated learning (Pintrich, 2000), which is much more relevant in secondary school, while primary school learning is considered to be much more externally regulated. Alternatively, these findings might again be viewed to provide initial clues in relation to the role self-regulation and WM might play in the association of mastery goals and academic success. These findings complement existing evidence with the within-person perspective, emphasizing the relevance of daily mastery goals for daily perceived academic success, at least in secondary school.

Moreover, in line with what had been hypothesized based on existing between-person research (e.g., Huang, 2012; Scherrer et al., 2020), models only considering the contribution of achievement goals in addition to covariates and models additionally considering self-regulation and WM performance showed that whether primary and secondary school students on average set higher performance-approach goals was irrelevant for their daily perceived academic success. The same was true for secondary school students considering their daily performance-approach goal levels. However, unlike hypothesized, on days primary school students reported higher performance-approach goals, they also reported higher perceived academic success. These results are nevertheless in line with earlier research, which showed largely mixed findings as to effects of performance-approach goals on students' success. The findings of the present investigation may thereby be viewed to parallel and complement earlier findings with the within-person level perspective.

Finally, unlike hypothesized and hence contrasting earlier between-person research showing largely negative effects of performance-avoidance goals on student learning (e.g., Huang, 2012; Scherrer et al., 2020), models only considering the contributions of achievement goals in addition to covariates and models additionally considering self-regulation and WM performance indicated that primary school students reporting higher average performance-avoidance goals reported higher daily perceived academic success, while performance-avoidance goal levels were irrelevant for secondary school students' daily academic success. Findings considering the within-person level indicated that primary school students reported higher perceived academic success on days they also reported higher performance-avoidance goals. Nevertheless, this association was no more evident when self-regulation and WM were additionally considered and not in secondary school students. Heightened daily levels of performance-avoidance goals may thus be assumed beneficial for daily perceived academic success in primary, but not secondary school. These findings might suggest that the relevance of achievement goal setting in primary schools is largely irrespective of goal quality, potentially because learning is much more externally regulated than in secondary school. In secondary school, however, mastery goal setting should be considered particularly beneficial.

Emphasizing the relevance of daily mastery goal setting in the school context, these findings complement earlier evidence with the within-person level. Additionally, the findings indicating positive associations of performance-avoidance goals with academic success in primary, but not anymore in secondary school, extend prior evidence largely considering older students.

### 4.3 | Associations of average self-regulation, WM, and achievement goals with report card grades

The present findings only partially supported our hypothesis that self-regulation, WM performance, and mastery goals should benefit report card grades, while performance-approach goals should be unrelated, and performance-avoidance goals detrimental. First, models only considering the contribution of self-regulation in addition to covariates and models additionally considering contributions of WM and achievement goals indicated primary and secondary school students' average self-regulation to be irrelevant for their report card grades, thereby countering expectations derived from largely cross-sectional evidence (e.g., Duckworth et al., 2019). These findings might be explained as the present study assessed self-regulation using only one item reflecting students' current concentration. Trait measures of self-regulation employed in earlier cross-sectional research might have captured broader aspects of this construct, however (e.g., Polderman et al., 2010).

Second, in line with expectations and prior research (e.g., Bull & Scerif, 2001; Carretti et al., 2009; Lechuga et al., 2014), models only considering the contribution of WM in addition to covariates and models additionally considering self-regulation and achievement goals showed primary and secondary school students with better WM to obtain better grades. These findings complement existing evidence and indicate that students' average daily WM performance as measured over four weeks at school is a relevant predictor of report card grades. These results can thus be viewed as a comparatively ecologically valid complement to earlier findings. Further, the findings complement earlier research only considering achievement goals, but not WM, and provide new insights as to the role WM might play for the association of achievement goals and academic success.

Finally, reflecting our expectations derived from prior research (e.g., Huang, 2012; Scherrer et al., 2020), models only considering contributions of achievement goals in addition to covariates showed

secondary school students with higher average daily mastery goals to obtain better and students with higher average daily performance-approach goals to obtain worse report card grades. However, contrasting assumptions, these findings were not evident in primary school students (note that more than 85% of variance in report card grades was explained by age, gender, class membership, and prior grades, however). Additionally, while negative associations between performance-avoidance goals and report card grades were expected, findings did not indicate meaningful associations. Hence, the findings suggesting achievement goals to be generally irrelevant for report card grades in primary school extend earlier evidence, while findings in relation to secondary school students' mastery and performance-approach goals confirm existing evidence and add new insights as to the effects of performance-avoidance goals on report card grades in the first year of secondary school. Importantly, however, findings of models additionally considering self-regulation and WM indicated a substantial drop in the relevance of achievement goals for secondary school students' report card grades. In fact, WM remained the only meaningful predictor, hence questioning the overall relevance of achievement goal orientations, while further emphasizing the relevance of WM.

### 4.4 | Associations of daily WM and achievement goals with self-regulation

The present findings only partly supported our expectation that WM performance and mastery goals should be positively associated with self-regulation at both the between- and the within-person level, while performance-approach and performance-avoidance goals should be unrelated. First, findings from models considering WM performance as the only predictor in addition to covariates showed that students with higher average WM performance did not report higher daily self-regulation. Likewise, on days students showed higher daily WM performance, they did not report higher daily self-regulation. These findings applied to both primary and secondary school students. As such, the findings contrast the overwhelming evidence provided by earlier research (e.g., Mischel et al., 2011; Moffitt et al., 2011; Rutherford et al., 2018). Given the comparably low reliability of the tasks used to assess daily WM and given that children's motivation to work on the tasks should have substantially influenced their performance, this finding should, however, be treated with caution. Additionally, the present investigation focused on one particular aspect of self-regulation, students' daily concentration, while prior research usually additionally assessed hyperactivity-impulsivity as a further behavioral facet (e.g., Polderman et al., 2010).

Second, in line with expectations (Kanfer, 1990; Payne et al., 2007; Pintrich, 2000), findings from models considering the distinct contributions of achievement goal orientations indicated that students reporting higher average mastery goals also reported higher daily self-regulation, while performance-approach and performance-avoidance goals were irrelevant. The results thereby emphasize the relevance of mastery goals for self-regulation. Findings considering the within-person level were largely comparable. On days students reported higher mastery goals, they also reported higher self-regulation. Taken together, the findings emphasizing the relevance of average and daily mastery goals for daily self-regulation complement earlier research largely only considering the between-person level.

### 4.5 | Associations of achievement goals with WM

The present findings only partly supported our expectation that mastery goals should be positively associated with WM performance at both the between- and the within-person level. First, secondary school students who reported setting higher mastery goals on average showed better daily WM performance. However, this finding was not evident in primary school students. The latter might again reflect the idea that mastery goals should be particularly relevant in self-regulated learning (Pintrich, 2000), which is much more relevant in secondary school, while primary school learning is considered to be much more externally regulated. As such, our findings complement earlier cross-sectional and largely laboratory-based experimental research with findings from real-life contexts and considering both the between and the within-person level (Avery & Smillie, 2013; K. Lee et al., 2014; Linnenbrink et al., 1999). In relation to performance-approach and performance-avoidance goals, findings from the present investigation correspond to expectations of no associations at the between-person level.

Second, mastery goals were not associated with WM performance at the within-person level, neither in primary nor secondary school students. As such, these findings might be viewed to complement earlier research considering the between-person level (Avery & Smillie, 2013; Lee et al., 2014; Linnenbrink et al., 1999). Nevertheless, given the comparably low reliability of the WM tasks used and given that children's motivation to work on the tasks should have substantially influenced their performance, this finding should be treated with caution. In relation to performance-approach and performance-avoidance goals, findings from the present investigation correspond to expectations of no associations at the within-person level either.

### 4.6 | Advancing self-regulation research

#### 4.6.1 | Distinguishing associations at the between- and the within-person level

The present investigation was, to our knowledge, the first to examine interrelations among key concepts of self-regulation research and to additionally differentiate findings at both the between- and the within-person level. While we consider the investigation of interrelations between these concepts important in itself, it is the distinction between associations at the between- and the within-person level that is of particular relevance. In fact, as partly supported by the present findings, effects at both levels may differ in strength and even direction (Molenaar & Campbell, 2009). Additionally, effects at the between- and

within-person level differ conceptually (Curran & Bauer, 2010). We are therefore convinced that research considering the within-person level is one crucial way to advance the field of self-regulation research.

### 4.6.2 | Measuring self-regulation and associated constructs in real life

Additionally, the present investigation was, to our knowledge, the first to consider interrelations among key concepts of self-regulation research using data reflecting students' actual experience and actual WM performance in a particular moment and in real life. It thereby contrasts earlier research considering self-reports inquiring about individuals' remembered and believed selves (Conner & Feldman Barrett, 2012) and must be assumed to have limited biasing effects associated with such latter self-reports. Thus, the present investigation may have substantially increased the ecological validity of results in comparison with prior research. Its findings may therefore be considered a much more accurate reflection of reality. We are certain that research considering individuals' momentary experiences in real life is a further decisive way to advance self-regulation research in the future.

### 4.6.3 | Bridging the gap between self-regulation and self-regulated learning

The present article theoretically situated its investigation primarily in the field of self-regulation research, which has predominantly been inspired by cognitive and developmental psychology (cf. Greene, 2017). However, in considering students' achievement goals, a theoretical framework rooted in the field of self-regulated learning and mainly researched in educational psychology and learning sciences, we attempted to bridge the gap between these two fields (cf. Greene, 2017). The present article thereby emphasized the connectibility between the two fields. As such, the present work indicating that cognitive resources (i.e., WM) and general indicators of self-regulation (i.e., being concentrated) are related to the daily processes of goal setting and achievement in academic learning contexts contributes to advance the field of both self-regulation and self-regulated learning.

## 4.7 | Limitations and perspectives

Future studies aiming to replicate and extend our findings may consider the following limitations. First, achievement goals were assessed as a domain-general construct for the whole school day and not separately for different subjects. As has already been suggested by Neubauer and colleagues (2022), certain proportions of the observed day-to-day variability might thus be attributable to different timetables. Martin and colleagues (2020) provided evidence that subject-specific goal orientations vary less over time than they vary across subjects.

Second, self-regulation was measured only once during the school day and only in relation to the current situation. Thus, information on self-regulation pertained to a relatively small time window, whereas information on other time-varying constructs (achievement goals, academic success) pertained to larger time windows. This discrepancy might have attenuated the strengths of associations examined.

Additionally, the reliability of the WM tasks used in the present study was comparably low at the within-person level, in particular in Study 1. This may have reduced the strength of effects that were actually present to such an extent that they were no longer statistically meaningful. This could also explain why proven effects in relation to WM could not be replicated in the present work. Future research may wish to further develop WM assessment in real life such that the reliability of measures is improved.

Moreover, self-regulation was measured using one item (i.e., "I am concentrated right now"), reflecting both the ability to direct attention to goal-relevant information and to inhibit responses to tempting or distracting stimuli. Scales assessing self-regulation as a trait similarly inquire about these abilities (e.g., Polderman et al., 2007). Nevertheless, they often also address children's motor activity, while also including items particularly dedicated to assess impulsiveness (e.g., "I can wait my turn"). Hence, future studies examining students' self-regulation on a daily basis might wish to additionally include items inquiring about children's daily motor activity and further items considering children's attention and response inhibition. This would also allow to determine the within-person reliability of such scales, while the present results can only suggest this item's reliability by demonstrating within-person couplings with constructs associated at the between-person level.

Furthermore, the present analyses controlled for autoregressive effects of outcome variables the day before. Nevertheless, future studies may wish to additionally examine the extent to which academic achievement on one day determines self-regulation and WM the next day using DSEMs (Asparouhov et al., 2017; Hamaker et al., 2018).

Finally, while the present investigation focused on constructs reflecting processes considered to be central to self-regulation at school, additional constructs such as academic self-concept, academic self-efficacy, and effort invested might be relevant in mediating or moderating students' daily self-regulation. Future research may wish to additionally consider the role of these constructs and thereby further seek to connect research on self-regulation and self-regulated learning.

## 5 | CONCLUSION

The present study examined the interrelations of self-regulation, WM performance, achievement goal orientations, and perceived academic success at both the between- and the within-person level in two samples, students right before and right after their transition from primary to secondary school. The results emphasized the relevance of daily self-regulation for daily perceived academic success in both samples. Additionally, they underscored the importance of daily mastery goals for daily perceived academic success. Moreover, findings indicated the relevance of students' WM performance as assessed in the everyday school context for report card grades. Finally, the relevance of

daily mastery goals for primary and secondary school students' daily self-regulation and the relevance of average mastery goals for secondary school students' daily WM performance was demonstrated. The present work thus complements existing self-regulation research with within-person level insights.

## ACKNOWLEDGMENTS

We would like to thank 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. For the SASCHA project, we would like to thank Aamir Sajjad for further developing the software. We further owe special thanks to Michaela Menstell, Anna-Maria Grimm, Elena Galeano-Keiner, and a team of highly committed student assistants. The SASCHA study is a project at the IDeA Research Center for Individual Development and Adaptive Education of Children at Risk, Frankfurt/Main, Germany, and is funded by the German Research Foundation (DFG; Deutsche Forschungsgemeinschaft; Grant SCHM 2411/9-1).

Open Access funding enabled and organized by Projekt DEAL.

## CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

## ETHICS STATEMENT

The study was approved by the Ethics Committee of the German Society for Psychology (DGPs).

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are openly available in the Open Science Framework (OSF) at https://osf.io/p2ws5.

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## SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

**How to cite this article:** Blume, F., Irmer, A., Dirk, J., & Schmiedek, F. (2022). Day-to-day variation in students' academic success: The role of self-regulation, working memory, and achievement goals. *Developmental Science*, *25*, e13301. https://doi.org/10.1111/desc.13301