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Students' Personality and State Academic Self-Concept: Predicting Differences in Mean Level and Within-Person Variability in Everyday School Life

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A positive academic self-concept (ASC) relates to many desirable educational outcomes. Research on which student characteristics relate to the formation of ASC is therefore crucial. To examine the importance of personality for ASC, we investigated the relation between Big Five traits and mean level as well as within-person variability in state general-school ASC for the first time using intensive longitudinal data. The sample comprised $N = 291$ German ninth and 10th graders who completed a 3-week e-diary after filling in a 60-item Big Five questionnaire assessing extraversion, agreeableness, conscientiousness, negative emotionality, and open-mindedness as well as their respective subfacets (15 subfacets overall). To assess state ASC, students completed three items after each lesson in four different subjects (resulting in $M_{\text{lessons}} = 21.32$). We ran six mixed-effects location scale models: one with all broad Big Five domains and five (one for each Big Five domain) with the subfacets as predictors of state ASC. Higher scores in the domains and in at least one subfacet of open-mindedness, conscientiousness, and extraversion but lower scores in negative emotionality were related to higher mean levels of state ASC. Higher scores in depression (subfacet of negative emotionality) were related to greater within-person variability in state ASC. These findings suggest that Big Five traits are predictors of mean level and within-person variability in students' state ASC, thus contributing to a more complete map of the formation of students' ASC and the role of personality therein. Theoretical and practical implications of these findings are discussed.

Educational Impact and Implications Statement
This study suggests that students' perceptions of their academic abilities (i.e., academic self-concept) undergo short-term fluctuations from school lesson to school lesson and that these fluctuations can partly be explained by students' personality. Overall, this study advances our theoretical understanding of academic self-concept as one of the most important motivational factors in educational contexts and highlights the relevance of personality as a set of noncognitive traits for students' daily academic motivation.

Keywords: state academic self-concept, Big Five personality, variability, experience sampling, intensive longitudinal data

Supplemental materials: https://doi.org/10.1037/edu0000760.supp

Academic self-concept (ASC)—defined as individuals' self-perceptions of their abilities in academic contexts (Marsh & Shavelson, 1985; Shavelson et al., 1976)—has proven to be influential for students in a variety of respects. Attaining a positive ASC is associated with higher task persistence, more adaptive cognitive and self-regulatory strategies, and higher cognitive engagement (Pintrich, 2003). Furthermore, a high ASC promotes subsequent academic achievement and success (e.g., Niepel et al., 2014; Trautwein, Lüdtke, Köller, & Baumert, 2006; Wolff et al., 2020; Wu et al., 2021), academic interests and effort (e.g., Marsh et al., 2005; Trautwein, Lüdtke, Schnyder, & Niggli, 2006), as well as academic choices and occupational aspirations (e.g., Guo et al., 2017, 2015; Nagy et al., 2006). As Pintrich (2003) has already pointed out, previous research on the strength of the relations between ASC and these outcomes suggests that ASC "is one of the best and most powerful motivational predictors of learning and achievement" (p. 109; see also Marsh, Seaton, et al., 2019; Trautwein & Möller, 2016). Consequently, current research focuses on obtaining a better understanding of ASC, which leads to the questions of how individuals actually form their ASC and which psychological characteristics lead to increases or decreases in ASC.

Work on these questions on ASC formation has thus far almost exclusively taken a between-person (interindividual) and long-term perspective, typically drawing on longitudinal panel studies with measurement intervals spanning from several months to years. Accordingly, ASC is generally assumed to be a stable personal characteristic across intervals of several months or even years (Jansen et al., 2020; Marsh & Yeung, 1998). However, when it comes to psychological variables, it is recognized that within-person (intraindividual) variability over a short period of time may contain additional important information about how individuals differ from each other, thus legitimizing the further investigation of intraindividual variability as well as between-person differences in this intraindividual variability (Fleeson, 2004; Nesselroade & Ram, 2004; Ram & Gerstorf, 2009). Indeed, first evidence suggests that students' ASC varies substantially from school lesson to school lesson (Niepel et al., 2021; Tsai et al., 2008).

Moreover, previous research has identified academic achievement as the main source of ASC, with an average positive correlation of $r = .56$ between self-concepts and school grades or achievement test scores (for a meta-analysis, see Möller et al., 2020). Thus, achievement reflects an individual's ASC to some extent, but ASC and measures of academic achievement are far from perfectly correlated with one another (Niepel et al., 2019) as a person's belief about their own academic abilities is not always convergent with their actual achievement (Trautwein & Möller, 2016). This suggests that further psychological variables also contribute to how individuals construe their beliefs about their academic competencies. First evidence on the trait level has found that some Big Five personality traits predict trait mathematics self-concept independently of academic achievement and cognitive abilities, thus suggesting that personality traits are important antecedents of trait ASC beyond achievement and ability (e.g., Jonkmann et al., 2012).

The present study builds on this preliminary evidence by taking an intraindividual perspective, focusing on lesson-to-lesson variation in state ASC. It sought to provide a better understanding of ASC variation from school lesson to school lesson by proposing personality traits as potential antecedents partly explaining this variation in state ASC. We focused on general-school ASC (e.g., "I'm good at most school subjects"). General-school ASC reflects students' overall perception of their academic abilities and is not tied to a specific academic domain or school subject (i.e., mathematics or verbal skills; Arens et al., 2021; see also Gogol et al., 2016). To investigate variation from school lesson to school lesson, we employed experience sampling to repeatedly measure state general-school ASC in the daily classroom setting among 291 German ninth- and 10th-grade students over 3 weeks. Experience sampling captures momentary experiences as they occur naturally in everyday life. This method allows us to investigate state ASC because students reported their current beliefs about their academic abilities in everyday situations (for reviews of experience sampling, see, e.g., Fahrenberg et al., 2007; Trull & Ebner-Priemer, 2013). To provide a more comprehensive understanding of potential sources of between-person differences in intraindividual variability in students' ASC, we aimed to extensively explore the relations between personality traits (i.e., Big Five) and state ASC.

Trait and State Academic Self-Concept

Generally, ASC is considered to be an individual difference trait that remains rather stable across relatively long time spans (Marsh & Yeung, 1998). Jansen and colleagues (2020), for example, described ASC as similarly stable and trait-like as personality characteristics, based on their finding that students' ASC exhibits substantial stability across time intervals of several months or even years. Accordingly, previous studies taking an interindividual perspective have found small, continuous, developmentally related changes in students' mean level of ASC. For example, several researchers have shown that the transition from elementary to secondary school results in a decline in ASC in early adolescence (e.g., Cole et al., 2001), which is followed by a further decline in students' ASC throughout their high school years (Wouters et al., 2012). However, while the ASC literature shows that students exhibit long-term tendencies in their perceptions of their abilities in academic situations (i.e., "trait" ASC), empirical evidence by Tsai et al. (2008) and Niepel et al. (2021) additionally suggests that students' ASC exhibits short-term fluctuations from one academic situation to another (i.e., "state" ASC). For instance, Tsai et al. (2008) found that about half of the total variance in students' domain-specific ASCs (48% in mathematics, 47% in German, 45% in English), which they referred to as competence beliefs, was attributable to the within-student level, meaning that students' ASC in a given subject did not remain constant over a 3-week period.

The idea that ASC exhibits meaningful short-term fluctuations is thereby in line with Shavelson et al.'s (1976) seminal theoretical conceptualization of self-concept. Overall, Shavelson et al. postulated a self-concept hierarchy where general self-concept is at the apex and can be divided into further components such as academic and nonacademic self-concept, which in turn can be grouped into even more specific subareas, while behavior in specific situations is located at the lowest level of this hierarchy. Regarding the structure of ASC, Shavelson et al. described general-school ASC (e.g., "I'm good at most school subjects") to be at the top of the hierarchy, domain-specific ASCs (e.g., "I am good at mathematics") at the next level, and even more task-specific ASCs at the subjacent level. As one descends this hierarchy, one's self-concept is thought

to become progressively more dependent on specific situations. This theoretical account of self-concept thus suggests that self-concept might fluctuate across contexts and time, reflecting ASC as a state. Niepel et al. (2021) recently advocated for conceptually disentangling the domain-level (or task) specificity of ASC from its situation (or temporal) specificity, resulting in two distinct dimensions: one ranging on a continuum from general-school to more task-specific ASC (i.e., general-school ASC vs. domain-specific self-concept) and one on a continuum from trait ASC to state ASC. Ample empirical research supports the notion that, in principle, any individual characteristic can be conceptualized as lying on a trait-to-state continuum and thus composed of trait as well as state features (Rauthmann, 2021; see Niepel et al., 2021). For example, Podsakoff et al. (2019) reported that, on average, 46% of the total variance in personality is attributable to within-person factors, suggesting that supposedly stable personality traits also entail state-like components.

With respect to ASC, we thus assume that general-school ASC could also be operationalized as both trait and state. It is readily imaginable that students experience short-term fluctuations in their perception of their academic abilities from one specific academic situation to another as they receive varying performance feedback from teachers or classmates—for example, because they received unexpected feedback or did not follow or understand the covered material as easily as they usually do (Niepel et al., 2021). This would imply that, independent of students' overall perceptions of their abilities, they perceive themselves as more competent during some lessons and less competent during others as they constantly reevaluate their own academic abilities at school. This renders it necessary to gain in-depth knowledge of fluctuations in students' state ASC (i.e., how students actually perceive their competencies in everyday school life) in order to integrate this evidence into our theoretical understanding of the nature and formation of ASC.

## Identifying Mean Level and Within-Person Variability in States

In contrast to traits, states are described as individuals' momentary tendencies (see Wang et al., 2012). In the present study, we considered between-person differences in mean level and within-person variability in state general-school ASC. Individuals differ in their mean level of state ASC over time independent of its variability, which can be interpreted as a student's typical expression of state ASC and approximates that student's trait manifestation when aggregated across all situations (how do individuals perceive their academic abilities on average across time and situations?; e.g., Harter & Whitesell, 2003; Kozina, 2019; Marsh & Yeung, 1998; Trautwein, Lüdtke, Köller, & Baumert, 2006). Further, students arguably differ in the variability of their state ASC across time, independent of their mean level, which refers to the degree of short-term fluctuation they experience (how do individuals fluctuate across time and situations in the perception of their academic abilities?; e.g., Harter & Whitesell, 2003; Kernis, 2005; Molloy et al., 2011; Tsai et al., 2008). Generally, both mean level and variability of psychological states have been found to exhibit meaningful between-person differences and to be stable over time, rendering it possible to investigate these between-person differences in intraindividual variability (e.g., Baird et al., 2006; Kernis, 2005; Molloy et al., 2011).

Figure 1 illustrates the importance of identifying these aspects of states in ASC based on our data (see "Method" section below). As shown in Figure 1, students may exhibit the same aggregate level of state general-school ASC, but their manifestation of this construct across time in the everyday classroom context and thus the extent to which their state general-school ASC fluctuates from one lesson to another may differ greatly. Consequently, these students also differ in how their aggregate level is achieved. Investigating between-person differences in intraindividual variability in state ASC would thus provide unique insight into the dynamic nature of ASC experiences above and beyond their mean level, which is relevant for enhancing our understanding of the nature of ASC over time.

Big Five Traits as Predictors of Mean Level and Within-Person Variability in State ASC

Personality traits are conceived as relatively stable patterns of affect, cognition, and behavior across time and situations (McCrae

Figure 1

Between-Person Differences in Mean Level and Within-Person Variability in State Academic Self-Concept (ASC)
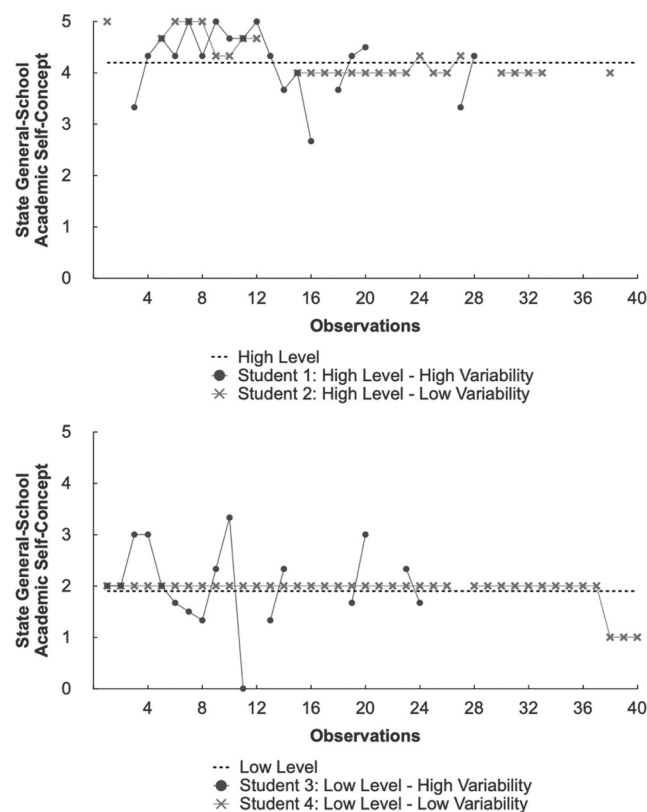
Note. e-diary ratings of state general-school ASC across a 3-week period (up to 40 observations) from four different students (some dots are not connected by a line due to missing data). The upper panel shows the state general-school ASC ratings of two students with relatively high aggregate levels ($M = 4.2$) but different degrees of variability in state general-school ASC, while the lower panel shows the state general-school ASC ratings of two students with relatively low aggregate levels ($M = 1.9$) but different degrees of variability in state general-school ASC.

& Costa, 2008). The Five-Factor (Big Five) model of personality is the most dominant and widely used model of personality structure in contemporary research (e.g., John, 2021). It identifies five largely independent and broad domains of personality (Soto & John, 2017): open-mindedness (or openness), conscientiousness, extraversion, agreeableness, and negative emotionality (or neuroticism; for a definition of each Big Five domain, behavioral examples, and prediction of external criteria, see, e.g., Chernyshenko et al., 2018, p. 11). The Big Five exhibit a hierarchical structure, with multiple narrower traits, referred to as subfacets, subsumed under each of the five domains (e.g., Soto & John, 2017). Each domain is thus thought to encompass several correlated but distinct subfacets, each of which captures unique personality information (Soto et al., 2011). The Big Five domains and their subfacets have proven to be valid predictors of a wide range of outcomes, including academic success, well-being, health, and work performance (De Fruyt et al., 2017; Soto & John, 2017). With regard to academic success, for example, a growing body of research has found that more conscientious and open-minded students obtain better school grades and standardized test scores, whereas agreeableness, negative emotionality, and extraversion have been found to show weaker and less consistent associations with achievement indicators (for a review, see Vedel & Poropat, 2017; for meta-analyses, see Almlund et al., 2011; Poropat, 2009). Moreover, empirical evidence has shown that the Big Five subfacet level has incremental and differential value compared to the domain level as the subfacets allow for a more comprehensive and fine-grained description of individual differences and enable a deeper understanding of the mechanisms underlying the trait-outcome relationships (Danner et al., 2021; Paunonen & Ashton, 2001).

Research by Jonkmann and colleagues (2012) found some Big Five domains to be predictors of trait mathematics self-concept independent of achievement and cognitive abilities, thus suggesting personality traits to be important antecedents of trait ASC beyond its most central predictor, an individual's academic achievement. More specifically, they showed by means of multilevel structural equation modeling that trait mathematics self-concept was higher among students who were less open-minded ($\beta = -.10$, $p < .001$) and more conscientious ($\beta = .12$, $p < .001$). Furthermore, they reported a negative correlation between trait mathematics self-concept and negative emotionality ($r = -.19$, $p < .001$) as well as extraversion ($r = -.06$, $p < .05$) and a positive correlation with conscientiousness ($r = .24$, $p < .001$); trait mathematics self-concept was unrelated to open-mindedness and agreeableness. Marsh et al. (2006) found open-mindedness to be related to trait verbal self-concept ($r = .49$), while conscientiousness was positively correlated with trait mathematics self-concept ($r = .26$). Shafer (2000) conducted regression analyses and found conscientiousness ($\beta = .39$, $p < .01$) to be a predictor of trait ASC in undergraduates.

Conceptually, such an association between Big Five traits and students' ASC is in line with several theoretical conceptions that differentiate between two classes of personality characteristics. Big Five traits are typically conceived as basic tendencies, core characteristics, or dispositional traits with higher stability and heritability than characteristic adaptations or surface characteristics, which in turn have a higher susceptibility to environmental influences (i.e., attitudes, roles, relationships, goals, self-concept, or self-esteem; Asendorpf & Motti-Stefanidi, 2017; Asendorpf & van Aken, 2003; McAdams & Pals, 2006; McCrae & Costa, 2008; for

a review, see Kandler et al., 2014). Basic tendencies are defined as individuals' abstract underlying potentials, which develop over time and are thought to be manifested in characteristic adaptations (McCrae & Costa, 2008). Hence, characteristic adaptations (e.g., an individual's ASC) can be considered the result of the dynamic interaction between more stable basic tendencies (i.e., Big Five traits) and ever-changing environmental demands (McCrae & Costa, 2008). Moreover, from a developmental perspective, it has been argued that basic tendencies (Big Five traits) influence the characteristic adaptations (ASC) rather than the other way around because Big Five traits and their temperamental precursors develop earlier than characteristic adaptations (Asendorpf & van Aken, 2003; Kandler et al., 2014; but see Weidmann et al., 2018). In their review, Kandler et al. (2014) concluded that self-related schemata (the authors focused on subjective well-being, self-esteem, and locus of control) indeed appeared to be less stable, more environmentally malleable reflections of basic tendencies. Relatedly, a more recent study by Pilarska (2018) found that Big Five traits explained 38% of the variance in trait self-esteem.

Additionally, considerable research has been conducted on so-called compound personality characteristics, which are thought to blend several aspects of multiple Big Five domains (Chernyshenko et al., 2018; Napolitano et al., 2021). Self-efficacy and self-esteem, which are both conceptually closely related to and yet distinct constructs from ASC (Marsh, Pekrun, et al., 2019; Marsh, Seaton, et al., 2019), have been identified as such compound characteristics. The notion of compound characteristics thus might also imply a potential relation between Big Five traits and ASC. As a compound characteristic, self-efficacy combines aspects of conscientiousness, negative emotionality, and extraversion, whereas self-esteem reflects a combination of negative emotionality, extraversion, and conscientiousness, along with its own unique aspects (Chernyshenko et al., 2018).

All in all, previous studies have found a positive association between conscientiousness and trait mathematics self-concept as well as further potential relations between negative emotionality, extraversion, and open-mindedness and trait mathematics or verbal ASC. More specifically, these first studies suggest that personality traits, as relatively stable individual characteristics, seem to be indeed related to students' trait ASC. However, this existing empirical evidence largely concerns the relationship between the Big Five domains and domain-specific trait ASC; to date, no empirical studies investigating the associations between the Big Five domains or their subfacets and state ASC exist. Thus, we cannot assume that these associations at the trait level will be mirrored at the state level (i.e., committing the ecological fallacy; Wilson et al., 2017).

However, researchers have already shown that Big Five personality traits predict mean level and within-person variability in state self-esteem, giving a preliminary indication of what we might expect with respect to the associations between Big Five traits and state ASC. With regard to levels of state self-esteem, these studies have found that conscientious and extraverted individuals reported higher levels of self-esteem, whereas neurotic individuals reported lower levels of state self-esteem; mixed findings or no relation have been reported regarding open-mindedness and agreeableness (Geukes, Nestler, Hutteman, Küfner, & Back, 2017; Meier et al., 2011; Zeigler-Hill et al., 2015). Regarding variability in state self-esteem, it has been found that negative emotionality is related to

increased variability in state self-esteem, whereas conscientiousness, extraversion, and agreeableness are mostly unrelated to or related to decreased variability; mixed findings have been reported with respect to open-mindedness (Geukes, Nestler, Hutteman, Küfner, & Back, 2017; Meier et al., 2011; Zeigler-Hill et al., 2015). Correspondingly, we might expect the Big Five domains and subfacets of negative emotionality, conscientiousness, and extraversion in particular to be potentially related to levels and/or variability in state ASC as well. However, previous findings on constructs that are distinct yet conceptually related to ASC do not allow us to draw conclusions about corresponding associations between ASC and the Big Five per se; they can only give a preliminary indication. Consequently, thus far, it remains unclear what role the Big Five traits play in students' overall perception of their academic abilities from school lesson to school lesson. For instance, one could easily imagine that depending on their personality, students attribute teachers' feedback, classroom contexts, or performance comparisons with peers differently to their academic abilities. For example, more extraverted students interact more frequently with their teachers and peers as they are better at seeking help from them when encountering learning difficulties, which ultimately enables better understanding (Vedel & Poropat, 2017) and leads to such students receiving feedback on their academic performance more frequently. This might lead to more extraverted students perceiving their ASC as higher across different school lessons. Hence, it is increasingly important to investigate the relevance of students' individual characteristics (i.e., personality) for their educational success. The present study thus contributes to advancing the theoretical understanding of ASC by examining whether the Big Five domains and their subfacets relate to students' state ASC in everyday school life. By exploring how paramount personality variables influence students' perception of their academic abilities in concrete situations, we additionally aimed to provide further evidence on the relevance of these individual characteristics for academic contexts.

The Present Study

The overarching aim of the present research was to explore intraindividual variability in students' state ASC in order to provide a more comprehensive understanding of the nature and potential antecedents of state ASC over time. Specifically, in the present study, we focused on state general-school ASC among German secondary school students in the daily classroom setting as collected through experience sampling over 3 weeks. In examining general-school ASC instead of domain-specific ASC, we took into consideration that Big Five traits are also domain-unspecific concepts that are not conceptually tied to specific school subjects (Arens et al., 2021). Further, we took a new approach to explaining the relations between personality traits and state ASC by investigating the nomological network of state ASC with lower-order facets of the Big Five in addition to the broader Big Five domains. The Big Five subfacets should yield more precise predictions of levels and variability in state ASC than the broad Big Five domains (Danner et al., 2021; Paunonen & Ashton, 2001). However, as no studies on the respective Big Five subfacet relations are already available, for the time being, we assumed to find similar Big Five domain (i.e., the higher-order construct) and Big Five subfacet (i.e., lower-order construct) relations because

conceptually and empirically (through previous research on the structure of the Big Five; Soto & John, 2017), the higher-order Big Five domain and its corresponding subfacets are part of the same theoretical construct space. We built on first evidence by Jonkmann et al. (2012) from an interindividual perspective and extensively explored whether Big Five domain and subfacet traits explain between-person differences in the levels and variability of state general-school ASC. We aimed at answering the following research questions separately for the Big Five domains and the Big Five subfacets:

Research Question 1: Are the Big Five traits associated with between-person differences in mean levels of state general-school ASC?

Previous empirical evidence on the trait level suggests that negative emotionality is negatively associated and the remaining Big Five domains positively associated with levels of trait ASC (Jonkmann et al., 2012; Marsh et al., 2006; Shafer, 2000). Although we cannot blindly assume that these effects will be mirrored at the state level, they give an indication of the associations we might find. Thus, we expected to find similar relations between the Big Five domains as well as their subfacets and levels of state general-school ASC across 3 weeks of experience sampling.

Research Question 2: Are the Big Five traits associated with between-person differences in within-person variability in state general-school ASC?

To the best of our knowledge, factors related to variability in state ASC have never before been addressed. Hence, this research question was exploratory in nature. Considering previous findings on the relation between Big Five domain traits and the related (yet distinct) construct of state self-esteem, one might expect to find an association with negative emotionality and/or its subfacets such that we find increased variability in state ASC (Geukes, Nestler, Hutteman, Küfner, & Back, 2017; Meier et al., 2011; Zeigler-Hill et al., 2015).

Research Question 3: Do these associations hold when students' grade point average (GPA), reasoning ability, and gender are controlled for?

GPA, reasoning ability, and gender have consistently been shown to be important between-person characteristics for ASC and the Big Five personality traits. Regarding ASC, previous empirical evidence has found that students with better school grades (Möller et al., 2020) as well as higher reasoning ability (e.g., Brunner et al., 2008; Chen et al., 2012) report higher trait domain-specific and general-school ASC. Furthermore, studies have revealed gender-related differences in trait ASC, with boys and young men typically reporting higher general-school ASC than girls and young women regardless of their actual academic achievement (e.g., Parker et al., 2018). With respect to the Big Five, it has been found that conscientiousness and open-mindedness in particular are related to secondary school students' grades (Poropat, 2009), and twin studies have revealed significant genetic or environmental associations between reasoning ability and negative emotionality, open-mindedness, as well as a range of subfacets from all Big Five domains (Bartels et al., 2012; Nikolašević et al., 2021).

Concerning the Big Five and gender, Soto and John (2017) reported significant gender differences for some domains and subfacets. Specifically, young women tend to be more conscientious, agreeable, and neurotic on the domain as well as subfacet level, while young men tend to be more open-minded (except for the subfacet aesthetics). Accordingly, it seems reasonable to consider these covariates in our main analyses.

Before addressing our three research questions, we examined the bivariate correlation between students' habitual (trait) general-school ASC and aggregated momentary (state) general-school ASC to provide initial empirical evidence for the convergent validity of state general-school ASC. To address our three research questions, we used mixed-effects location scale models (MELS; Hedeker et al., 2008; Hedeker & Nordgren, 2013).

Method

Participants and Procedure

Data collection was part of the larger "Dynamics of Academic Self-Concept in Everyday Life" (DynASCEL) project, which focuses on everyday dynamics of students' ASC (Niepel et al., 2021).[1] A convenience sample of German academic-track secondary schools (i.e., Gymnasium; 44% of all German students attend Gymnasium; Autorengruppe Bildungsberichterstattung, 2018) were recruited for participation. Our sample consisted of 18 classes (Grades 9 and 10) from six secondary schools in four different German federal states (Baden-Württemberg, Mecklenburg-Vorpommern, North Rhine-Westphalia, Rhineland-Palatinate). Data collection took place at the respective schools over a period of 5 weeks. In Week 1, students completed a background inventory (paper-pencil assessment); in Weeks 2 to 4, each student received a smartphone for the 3-week experience sampling (e-diary); in Week 5, students were asked to complete a shorter postquestionnaire (paper-pencil assessment). For the experience-sampling phase, we chose a 3-week data collection period as we appraised this time span to be sufficiently long to capture a broad bandwidth of everyday situations in school yet still feasible with regard to students' commitment and perseverance (see Tsai et al., 2008, for a similar rationale).

$N = 382$ students participated and provided data during at least one of the project's three assessment phases (i.e., background inventory, e-diary, postquestionnaire), representing a participation rate of 83%. The present study drew upon data from the background inventory and the e-diary (see "Measures" section). The analyses for the present study drew only on students who provided data for both the personality trait measure (i.e., response to at least one of the four items for each subfacet is available; $N = 3,45$)[2] and the state general-school ASC measure (i.e., responses from at least three measurement points are available;[3] $N = 356$), resulting in a total of $N = 291$ students.[4] The students' self-reported mean age was 15.32 years ($SD = .69$, range = 13–17 years; based on $n = 281$); 39.2% were young men (based on $n = 285$).

The e-diaries were implemented using the Android-based experience-sampling app movisensXS (Version 1.3.0–1.3.4; Movisens GmbH, 2017). Students received prompts through an auditory signal requesting that they complete a brief electronic questionnaire on their smartphone at the end of each mathematics, German,

physics, and English lesson across a period of 3 school weeks (i.e., between 16 and 42 lessons per student were programmed depending on each class's timetable). Students could skip prompts or specific questions during the e-diary phase. Participants were carefully instructed in the use of the e-diary and were told to contact the researchers in case of uncertainties or technical problems during the study period.

As expected in intensive longitudinal designs, missing values occurred for multiple reasons, such as students' or teachers' illness, exams, or other obligations, as well as technical or logistical problems (e.g., students left their smartphone at home, empty battery). Per design, students were instructed to decline prompts when they had not had classroom instruction or were absent from school. The present sample for state general-school ASC included a total of 6,204 valid prompts out of 8,594 theoretically possible prompts, which represents 72.2% of the maximum possible data, indicating high compliance. On average, students replied to 21.32 prompts ($SD = 7.02$, $Mdn = 22.00$, min = 3, max = 41).

Students' participation was voluntary; written parental consent was obtained for all participating students. The local institutional review board of the University of Luxembourg as well as the education authorities of the respective federal states approved all procedures.

Measures

Big Five Traits

Open-mindedness, conscientiousness, extraversion, agreeableness, and negative emotionality were assessed with the German version (Danner et al., 2019) of the 60-item Big Five Inventory 2 (BFI-2; Soto & John, 2017). The BFI and its short forms are established instruments to assess Big Five personality traits economically and are thus especially recommended for use in research settings (John, 2021). The BFI-2 assesses 15 subfacets of the Big Five (i.e., three for each domain, with four items each) as well as the five overall domains (see Table 1). Students indicated their

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[1] Other articles focusing on different research questions have been and will be based on data from the larger research project (e.g., Dörendahl et al., 2021; Niepel et al., 2021). Data on the article's core variables (i.e., state general-school ASC and Big Five traits) have not previously been reported in other articles.

[2] The participation rate for the background inventory in the context of the present study was 75%. This rate ranged between 53% and 93% per participating school (i.e., a total of six schools) and between 28% and 100% per participating class (i.e., a total of 18 classes).

[3] A minimum of three measurement points per participant is required to estimate variance in longitudinal designs (e.g., Ployhart & MacKenzie, 2014).

[4] From the total of students who provided responses to the background inventory, we excluded $n = 3$ students because they either did not respond to any Big Five items or they did not respond to at least one of the four items for each Big Five subfacet; $n = 34$ students because they did not participate in the projects' e-diary phase, did not respond to the state general-school ASC items, or did not respond to at least three measurement points; and $n = 20$ students because their responses to the background inventory and the e-diary phase could not be matched due to a technical problem. The analytical sample ($N = 291$) did not differ from these excluded students ($N = 57$) with regard to their Big Five, trait general-school ASC, school grades (GPA), reasoning ability, or age; however, gender differences were found. The analytical sample consisted of significantly more young women than young men, $r(340) = .19$, $p < .001$, compared to the subsample of excluded students.

Table 1

The Big Five Inventory (BFI-2) Domain and Subfacet Scales: Names and Example Items

BFI-2 domain and subfacet scales	Example items
Open-mindedness	
Aesthetic sensitivity	Thinks poetry and plays are boring (R)
Intellectual curiosity	Is complex, a deep thinker
Creative imagination	Is inventive, finds clever ways to do things
Conscientiousness	
Organization	Is systematic, likes to keep things in order
Productiveness	Is efficient, gets things done
Responsibility	Is dependable, steady
Extraversion	
Sociability	Is outgoing, sociable
Assertiveness	Is dominant, acts as a leader
Energy level	Rarely feels excited or eager (R)
Agreeableness	
Compassion	Feels little sympathy for others (R)
Respectfulness	Is polite, courteous to others
Trust	Is suspicious of others' intentions (R)
Negative emotionality	
Anxiety	Is relaxed, handles stress well (R)
Depression	Often feels sad
Emotional volatility	Is moody, has up and down mood swings

Note. Reverse-keyed items are denoted by (R). The common stem for all items is "I see myself as someone who. . . ." The first facet of each domain is assumed to be most central to the corresponding domain (Danner et al., 2019). Adapted from "The Next Big Five Inventory (BFI-2): Developing and Assessing a Hierarchical Model With 15 Facets to Enhance Bandwidth, Fidelity, and Predictive Power," by C. J. Soto and O. P. John, 2017, *Journal of Personality and Social Psychology*, *113*(1), p. 142 (https://doi.org/10.1037/pspp0000096). Copyright 2017 by American Psychological Association.

responses on a 5-point Likert scale (0 = *strongly disagree* to 4 = *strongly agree*). Reverse-coded items were recoded prior to further analyses so that higher scores indicate greater manifestation of the trait. Danner et al. (2019) reported internal consistencies ranging from $\omega = .81$ to $\omega = .87$, with a mean of .84 and test-retest reliabilities (6-week interval) of at least .82, for the 12-item domain scales and ranging from $\omega = .66$ to $\omega = .87$, with a mean of .77 and test-retest reliabilities (6-week interval) between .58 and .85, for the four-item subfacet scales.

State General-School Academic Self-Concept (e-Diary)

State general-school ASC was reported by students at the end of every mathematics, German, physics, and English lesson during a time period of 3 weeks. Students' state general-school ASC was assessed with three items based on the Self-Description Questionnaire (Marsh et al., 1983), which is considered one of the best self-concept instruments (Byrne, 2002). Gogol and colleagues (2014) showed that three-item short measures based on the Self-Description Questionnaire are psychometrically sound for educational research purposes. The items were adjusted to better refer to the specific context of data collection through experience sampling by prefixing every item with "Currently, I think that. . .." The specific item wordings were "Currently, I think that I am good at most school subjects," "[. . .] work in most school subjects is easy for me," and "[. . .] I learn things quickly in most school subjects." Students were asked to report the extent of their agreement to these three items at each measurement point by responding on a 6-point Likert scale ranging from 0 (*strongly disagree*) to 5 (*strongly agree*) such that higher item scores indicated higher state general-school ASC. Available items were averaged to create a mean score per student and measurement point, which we refer to as state ASC in the remainder of this article.

Trait General-School Academic Self-Concept

Prior to the e-diary phase, students reported their trait general-school ASC based on the instrument developed by Gogol et al. (2014) and the Self-Description Questionnaire (Marsh et al., 1983). This questionnaire measures trait general-school ASC with six items, to which students indicate the extent of their agreement on a 6-point Likert scale ranging from 0 (*strongly disagree*) to 5 (*strongly agree*). Three of these six items correspond to the three items used in the e-diary (e.g., "I am good at most school subjects"); the other three items are "I get good marks in most school subjects," "I have always done well in most school subjects," and "I am hopeless in most school subjects." Reverse-coded items were recoded prior to further analyses such that higher scores indicated greater manifestation of the trait.

Covariates

School Grades. Students were asked to report their school grades from their last report cards. Hence, these self-reported grades represent students' cumulative academic achievement during the preceding school term rather than merely grades from single tests. Research drawing on German-speaking secondary school samples has shown that self-reported school grades can be assumed to be valid and to not be subject to systematic reporting bias (Dickhäuser & Plenter, 2005; Sparfeldt et al., 2008; Sticca et al., 2017). In the present study, we averaged students' self-reported grades across the school subjects of mathematics, physics, biology, chemistry, German, English, geography, and history to determine students' GPA. As German school grades range from 1 (*very good*) to 6 (*insufficient*), with higher numbers representing poorer achievement, we recoded them prior to further analyses such that higher numbers indicated better achievement.

Reasoning Ability. Students' reasoning ability was measured using the German-language Intelligence Structure Test-Screening (Intelligenz-Struktur-Test-Screening; Liepmann et al., 2012). The Intelligence Structure Test-Screening is a well-established and economic measure to assess adolescents' general intelligence in less than 30 min (Petermann, 2014) and is comprised of three subtests of 20 items each encompassing verbal, numerical, and figural material, respectively. We applied Parallel Version A of this screening instrument and used the reasoning ability raw composite score of these three subtests in the present study. Liepmann et al. (2012) reported good internal consistency for the full-scale composite score of reasoning ability ($\alpha = .87$).

Analytical Strategy

To explore the associations between students' between-person differences in mean level and within-person variability in state general-school ASC on the one hand and the five domains and 15 subfacets of the Big Five personality traits on the other, the present study applied MELS (see Hedeker et al., 2008, and Hedeker & Nordgren, 2013, for extensive descriptions of this method). MELS was developed within the maximum likelihood framework to model between-person differences in intraindividual variability in intensive longitudinal data with repeated individual observations (Level 1) nested within individuals (Level 2) in a single step (Hedeker et al., 2008). MELS is an extension of the standard multilevel model; it enables estimating between-person differences in the random intercept (i.e., level) and random slope (i.e., temporal trends) as well as in the residual variance (i.e., variability) because MELS relaxes the assumption of homoscedasticity. A log-linear function is used to model the variability component. Considering that MELS allows the level, temporal trend, and variability to vary between participants, person-level variables, and covariates (i.e., Big Five domain and subfacet traits, GPA, reasoning ability, gender) can be included to predict between-person differences in the level, temporal trends, and variability. Notably, in the present study, the specified MELS models account for the interdependence among levels and variability while simultaneously estimating how between-person differences uniquely predict the level (location) and variability (scale) of the outcome of interest (see Križan & Hisler, 2019, for a similar methodology).

MELS has the following advantages over other approaches when modeling intraindividual variability (Geukes, Nestler, Hutteman, Dufner, et al., 2017): First, by including a time variable, the model is able to control for potential temporal trends. Second, the effects of predictors on between-person differences in level and variability can be estimated in a single model. Third, the covariance between each person's level and variability are considered in the model estimation as level and variability are correlated random variables (see Baird et al., 2006, for an extensive discussion).

Thus, in the present study, we applied MELS to estimate students' level and variability in state general-school ASC while accounting for the interdependence among level and variability. MELS was conducted using the standalone program MixWILD (Version 1.0; Dzubur et al., 2020). MixWILD includes only complete data on any predictor as well as outcome variable at a specific measurement point in the analyses (i.e., missing at random assumption; Hedeker & Nordgren, 2013; Little & Rubin, 2002). In accordance with our research questions, the level and variability, but not the temporal trends (i.e., random slope), were allowed to vary between participants. To nonetheless account for temporal trends in state general-school ASC over the 3-week period, a time variable was included in all our models (see Wang & Maxwell, 2015). The prompts received by the students within the e-diary phase were programmed based on their class's timetable, resulting in 16 to 42 measurement points per student. A continuous time variable was then constructed from these different measurement points corresponding to the time difference in hours between the current and the first measurement point. Specifically, in our main analyses, we first calculated a null model (i.e., no personality predictors) in which only the time variable was used to predict the outcome (i.e., state general-school ASC) at various time points. Subsequently, we tested a total of six separate models: (a) on the broader domain level, one model specified with all five z-standardized Big Five domains and the time variable as predictors, and (b) on the subfacet level, one model per Big Five domain specified with its three z-standardized subfacets and the time variable as predictors, in both cases explaining between-person differences in mean level and within-person variability of the outcome variable, namely students' state general-school ASC. We opted for this approach in an attempt to facilitate model convergence by decreasing model complexity. Additionally, we recalculated these same six models while simultaneously controlling for GPA (z standardized), reasoning ability (z standardized), and gender as covariates. We applied Holm-Bonferroni correction for multiple comparisons with the family-wise α set at .05 to avoid Type-I errors (Holm, 1979). Additionally, we report effect sizes and their confidence intervals (Cumming, 2014).

Results

Preliminary Analyses

We calculated descriptive statistics for all variables of interest. These calculations were conducted using SPSS Statistics (Version 27; using listwise deletion) and RStudio (Version 1.2.5019) using the package "psych" (Version 1.8.12; to estimate McDonald's omega). Table 2 displays means and internal consistencies of the between-person characteristics. Internal consistencies were all satisfactory, ranging from $\omega = .60$ to $\omega = .94$. With regard to the Big Five (0–4 scale), scores for the sample at the domain level as well as the subfacet level were comparable to the values reported by Soto and John (2017).

To provide some first evidence on the convergent validity of our state ASC measure, we analyzed the bivariate correlation between students' habitual (trait) general-school ASC and aggregated momentary (state) general-school ASC. Aggregated state ASC and trait ASC correlated significantly with each other, $r(291) = .58$, $p < .001$.

Table S1 (see online supplemental materials) displays bivariate correlations between all examined variables. The bivariate correlations between the Big Five and trait general-school ASC were mostly consistent with past research, thus validating previous findings (e.g., Jonkmann et al., 2012; Marsh et al., 2006). The Big Five domains of open-mindedness, conscientiousness, extraversion, and agreeableness as well as most of their subfacets were

Table 2
Descriptive Statistics and Reliability Coefficients

Variable	*M*	*SD*	Min ; max	ω
Open-mindedness	2.26	0.62	0.58 ; 3.92	.84
Aesthetic sensitivity	1.99	0.96	0 ; 4	.76
Intellectual curiosity	2.35	0.73	0.50 ; 4	.66
Creative imagination	2.45	0.74	0 ; 4	.80
Conscientiousness	2.36	0.60	0.42 ; 3.92	.87
Organization	2.44	0.94	0 ; 4	.89
Productiveness	2.08	0.71	0 ; 4	.74
Responsibility	2.56	0.55	0.75 ; 4	.60
Extraversion	2.38	0.61	0.67 ; 4	.87
Sociability	2.43	0.86	0 ; 4	.84
Assertiveness	2.37	0.71	0.50 ; 4	.76
Energy level	2.33	0.65	0.50 ; 4	.66
Agreeableness	2.66	0.58	0.67 ; 3.92	.87
Compassion	2.82	0.76	0 ; 4	.82
Respectfulness	2.93	0.64	1 ; 4	.76
Trust	2.22	0.71	0.25 ; 4	.71
Negative emotionality	1.70	0.64	0 ; 3.75	.88
Anxiety	1.98	0.73	0 ; 4	.66
Depression	1.39	0.83	0 ; 4	.84
Emotional volatility	1.72	0.77	0 ; 4	.76
State general-school ASC (*M*)	3.39	0.73	0.98 ; 5	—
State general-school ASC (*SD*)	0.34	0.29	0 ; 2.11	—
Trait general-school ASC (*M*)	3.47	0.91	0 ; 5	.94
GPA	4.50	0.71	2.50 ; 6	.91
Reasoning ability	43.77	5.70	26 ; 56	.79

Note. Data displayed in this table are based on 283 to 291 subjects, depending on the variable, due to missing data. The state general-school ASC variables refer to aggregated state ASC per student across time and the standard deviation thereof (i.e., calculated with SPSS). Reliabilities are depicted in terms of McDonald's omega (ω). Min = minimum; max = maximum; ASC = academic self-concept; GPA = grade point average.

positively correlated with trait general-school ASC, while negative emotionality and all of its subfacets were negatively correlated. Similar relations were found between the Big Five domains and their subfacets on the one hand and aggregated state levels of ASC per student (i.e., obtained from the e-diary data) on the other. Furthermore, only the subfacet depression (negative emotionality) was positively correlated with aggregated state variability in ASC per student (i.e., obtained from the e-diary data). These findings thus give initial insights into the bivariate associations between Big Five traits and levels of and variability in general-school ASC at the state level; however, they do not allow for drawing conclusions about the results of the MELS.

The correlations between aggregated state levels as well as trait general-school ASC and the covariates were in line with previous research (Brunner et al., 2008; Chen et al., 2012; Möller et al., 2020; Parker et al., 2018; see Table S1 in the online supplemental materials). Students who reported higher general-school ASC tended to have a higher GPA and higher reasoning ability. Gender differences were found only for aggregated state general-school ASC, with young men indicating higher general-school ASC than young women. In a similar vein, the correlations between the Big Five and the covariates were mostly consistent with previous research (Bartels et al., 2012; Nikolašević et al., 2021; Poropat, 2009; Soto & John, 2017; see Table S1 in the online supplemental materials). Regarding the Big Five, high open-mindedness, conscientiousness, and agreeableness but low negative emotionality significantly related to higher GPA. At the subfacet level, a higher

manifestation of intellectual curiosity (open-mindedness) but a lower manifestation of sociability (extraversion) related to higher reasoning ability. Young women indicated being more open-minded, conscientious, extraverted, agreeable, and neurotic than young men.

To provide initial insights into the intensive longitudinal (e-diary) data, we conducted a multilevel confirmatory factor analyses (MCFA; Kim et al., 2016) of the employed state general-school ASC measure using Mplus (Version 8; Muthén & Muthén, 1998–2017). To account for the factor structure at Level 1 (i.e., within-person level) and Level 2 (i.e., between-person level), we employed the Mplus MLR estimator as it is robust against mild violations of normality and allowed us to deal with missing data (Kaplan, 2009). The MCFA for state general-school ASC resulted in a just-identified model with significant factor loadings ($p < .001$) on each of the three items (ranging from .943 to .958 at Level 2 and from .677 to .765 at Level 1). Explained variance ranged from .974 to .997 at Level 2 ($p < .001$) and from .458 to .586 at Level 1 ($p < .001$). We examined level-specific reliabilities for Level 1 and Level 2 by freely estimating all factor loadings and fixing the factor variances to 1 at both levels (Geldhof et al., 2014). The results indicated good reliability at each level (with ω = .995 at Level 2 and ω = .771 at Level 1). Thus, at Level 2, 99.5% of the total variance could be considered true score variance, and at Level 1, 77.1% of the total variance represents true score variance. Finally, we examined the intraclass correlation (ICC) for state general-school ASC. The ICC was .75 for each of the three state general-school ASC items, indicating that approximately 25% of the variance (including measurement error) in general-school ASC occurred within students.[5]

A subsample of $N = 41$ students showed no variance at all in state general-school ASC over the 3 weeks of data collection and were thus excluded from the MELS. This subsample (i.e., students with zero variance in state ASC) had significantly lower means in the Big Five domain negative emotionality, $r(291) = -.15$, $p = .013$, compared to students who exhibited variance in state general-school ASC over the 3 weeks. At the subfacet level, this subsample exhibited significantly lower means in the two negative emotionality subfacets of anxiety, $r(291) = -.16$, $p = .007$, and depression, $r(291) = -.13$, $p = .024$, compared to students exhibiting variance in state general-school ASC. The means of all other personality domains and subfacets did not significantly differ between this subsample and the analysis sample.

Main Analyses

To address Research Questions 1 and 2, we applied MELS to simultaneously model the unique influences of the Big Five

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[5] The ICCs for the three state general-school ASC items at the classroom level (i.e., students were nested into 18 different classrooms) were small, ranging from .013 to .014. Due to these small ICCs, it is not required to explicitly model a third level (i.e., classrooms; Hox et al., 2017). However, to account for potential classroom-level effects, we attempted to additionally run our main analyses by including class indicators (i.e., 17 dummy variables representing 18 different classes). None of these models converged, probably due to their high level of complexity.

domains and their subfacets on both the mean level of and variability in state general-school ASC, allowing us to further investigate state general-school ASC among students who experienced variability in their ASC over time.[6] By estimating the effects of the Big Five on the level as well as variability in state general-school ASC in a single model, we simultaneously controlled for the effects of students' levels of state general-school ASC on variability and vice versa. To examine the robustness of these relations, we additionally included covariates in the analyses (i.e., Research Question 3).[7] Due to missing data on the covariates, these analyses were based on a reduced sample size ($N = 240$, $N_{obs} = 5,040$). Tables 3 and 4 display the results of the MELS separately for level and variability in state general-school ASC and the Big Five domains as well as the 15 Big Five subfacets with and without inclusion of the covariates. Akaike information criterion (AIC) and Bayes information criterion (BIC) as measures of model fit are displayed in Table 5. To increase the comparability of the model specified with all Big Five domains (Model 1 in Tables 3 and 4) and the models specified with the subfacets of each broader Big Five domain (Models 2–6 in Tables 3 and 4), we additionally tested one model per broader Big Five domain as predictors of state general-school ASC (Models 7–11; with and without covariates). The respective results are depicted in Tables S2–S4 in the online supplemental materials.

Null Model

Results of the null model (AIC = 1,829.317; BIC = 1,853.967) indicated that students significantly differed from each other in their level of state general-school ASC (intercept: .530 on the log scale, $p < .001$) as well as in their variability (variability: 1.672 on the log scale, $p < .001$). Additionally, higher levels of state general-school ASC went along with decreased variability (covariance: −.514 on the log scale, $p < .001$).

Predicting Between-Person Differences in Mean Level

With respect to students' levels of state general-school ASC across 3 weeks, three of the five Big Five domains were found to be statistically significant predictors in Model 1, representing small-sized effects (Cohen, 1988). Students who were more open-minded (β = .152, adjusted $p < .001$) and more conscientious (β = .158, adjusted $p < .001$) reported higher levels of state general-school ASC across school lessons. Students with greater negative emotionality (β = −.206, adjusted $p < .001$) reported lower levels of state general-school ASC. These relations held when controlling for GPA, reasoning ability, and gender, and an additional association with extraversion emerged, with higher levels of state general-school ASC among more extraverted students (β = .102, adjusted $p = .043$; see Table 3).

Significant associations were also found between students' Big Five subfacets and their levels of state general-school ASC across 3 weeks, indicating small- to medium-sized effects (Cohen, 1988). Model 2 examined the associations between the three subfacets of open-mindedness and the level of state ASC and showed that more intellectually curious (β = .195, adjusted $p < .001$) and more creatively imaginative students (β = .130, adjusted $p = .009$) reported higher levels of state general-school ASC across 3 weeks. Model 3 (subfacets of conscientiousness) found that more productive (β = .171, adjusted $p = .003$) and more responsible (β = .131, adjusted $p = .021$) students reported higher levels of state general-school ASC. Model 4 (subfacets of

extraversion) found that students reporting greater assertiveness (β = .144, adjusted $p = .010$) and energy level (β = .189, adjusted $p = .001$) reported higher levels of state general-school ASC across school lessons. Model 5 (subfacets of agreeableness) showed that students with higher levels of respectfulness (β = .129, adjusted $p = .049$) reported higher levels of state general-school ASC. Model 6 (subfacets of negative emotionality) showed a significant negative association between the depression subfacet and state ASC. Students indicating greater depression (β = −.324, adjusted $p < .001$) reported lower levels of state general-school ASC. Except for the associations with the subfacets responsibility (Model 3) and respectfulness (Model 5), these associations with levels of state general-school ASC remained after controlling for GPA, reasoning ability, and gender (see Table 3).

Predicting Between-Person Differences in Within-Person Variability

With regard to variability in state general-school ASC across 3 weeks, we found a significant result for one subfacet of negative emotionality (Model 6), indicating a medium effect size (Cohen, 1988). Specifically, students indicating greater depression (β = .325, adjusted $p = .047$) reported greater variability in state general-school ASC over 3 weeks. To better interpret this variability in state ASC, the changes in within-student variability in state ASC associated with a 1-unit increase in the depression subfacet were converted to percentage changes (see Huisingh-Scheetz et al., 2020, for detailed methodology). Each additional depression point (i.e., 1-standard-deviation increase) was significantly associated with 38.4% greater variability in students' state general-school ASC (variance ratio: 1.384; 95% confidence interval [1.06, 1.80]). Put differently, a 1-standard-deviation increase in students' depression scores was related to a 38.4% more variable ASC.

None of the broader Big Five domains appeared as significant statistical predictors of variability in state general-school ASC, nor were any of the subfacets of open-mindedness, conscientiousness, extraversion, or agreeableness significantly associated with

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[6] All participants provided at least three observations. As a robustness check, we additionally ran our models on the subset of participants who provided at least 10 observations ($N = 235$, $N_{obs} = 5,173$). These analyses only marginally differed from our initial analyses based on at least three measurement points per student when controlling for the covariates. Regarding levels of state general-school ASC, eight out of 10 statistically significant relations (analyses based on participants with at least three observations) remained. Only two no longer reached significance when using at least 10 observations: the subfacets intellectual curiosity (open-mindedness) and assertiveness (extraversion; see Tables S5 and S7 in the online supplemental materials). With respect to variability in state general-school ASC, the pattern of findings remained the same (see Tables S6 and S8 in the online supplemental materials). Model fit for each model is depicted in Table S9 in the online supplemental materials.

[7] We additionally conducted analyses controlling for the school subject after which state general-school ASC was assessed. To this end, we added three dummy variables (i.e., representing the respective four school subjects) into our analyses. We obtained virtually the same pattern of effect sizes for these analyses as we did in our initial analyses. However, we observed slight differences after applying the Holm-Bonferroni method as we considered three more variables (i.e., the three dummy variables). As a result, fewer associations reached statistical significance than in the main analyses (see Tables 3 and 4). Importantly, our main finding of more depressed students reporting greater variability in state general-school ASC remained statistically significant. The results and model fit for each model are depicted in Tables S10–S12 in the online supplemental materials.

Table 3

Mixed-Effects Location Scale Model With Personality Predicting Mean Levels of State General-School Academic Self-Concept

		State general-school academic self-concept									
		Level (without covariates)					Level (with covariates)				
				95% CI					95% CI		
Model	Variable	Estimate	SE	LL	UL	p^a	Estimate	SE	LL	UL	p^a
Model 1: Big Five domains	Open-mindedness	**.152**	**.040**	**.073**	**.230**	**< .001**	**.155**	**.040**	**.078**	**.233**	**< .001**
	Conscientiousness	**.158**	**.043**	**.074**	**.242**	**< .001**	**.138**	**.045**	**.049**	**.226**	**.002**
	Extraversion	.063	.042	−.019	.144	.134	**.102**	**.042**	**.020**	**.183**	**.014**
	Agreeableness	−.041	.043	−.125	.043	.337	−.003	.043	−.088	.082	.948
	Negative emotionality	**−.206**	**.044**	**−.293**	**−.120**	**< .001**	**−.150**	**.048**	**−.244**	**−.055**	**.002**
	GPA	—	—	—	—	—	**.183**	**.045**	**.094**	**.272**	**< .001**
	Reasoning ability	—	—	—	—	—	.004	.042	−.077	.086	.919
	Gender	—	—	—	—	—	**−.282**	**.095**	**−.467**	**−.096**	**.003**
Model 2: Open-mindedness subfacets	Aesthetic sensitivity	−.069	.047	−.162	.024	.145	−.012	.049	−.108	.085	.815
	Intellectual curiosity	**.195**	**.047**	**.102**	**.287**	**< .001**	**.119**	**.048**	**.026**	**.213**	**.012**
	Creative imagination	**.130**	**.045**	**.041**	**.218**	**.004**	**.137**	**.044**	**.052**	**.223**	**.002**
	GPA	—	—	—	—	—	**.253**	**.046**	**.162**	**.344**	**< .001**
	Reasoning ability	—	—	—	—	—	−.051	.043	−.136	.034	.236
	Gender	—	—	—	—	—	**−.234**	**.092**	**−.414**	**−.054**	**.011**
Model 3: Conscientiousness subfacets	Organization	−.008	.050	−.106	.089	.868	.009	.050	−.088	.107	.850
	Productiveness	**.171**	**.051**	**.071**	**.271**	**< .001**	**.134**	**.051**	**.034**	**.233**	**.009**
	Responsibility	**.131**	**.051**	**.031**	**.232**	**.010**	.120	.052	.019	.221	.020
	GPA	—	—	—	—	—	**.189**	**.048**	**.095**	**.284**	**< .001**
	Reasoning ability	—	—	—	—	—	−.014	.043	−.100	.071	.739
	Gender	—	—	—	—	—	**−.298**	**.089**	**−.472**	**−.123**	**< .001**
Model 4: Extraversion subfacets	Sociability	−.106	.056	−.215	.002	.055	−.051	.054	−.157	.056	.346
	Assertiveness	**.144**	**.052**	**.043**	**.246**	**.005**	**.130**	**.049**	**.034**	**.227**	**.008**
	Energy level	**.189**	**.053**	**.085**	**.292**	**< .001**	**.165**	**.053**	**.062**	**.268**	**.002**
	GPA	—	—	—	—	—	**.244**	**.046**	**.153**	**.335**	**< .001**
	Reasoning ability	—	—	—	—	—	−.006	.044	−.092	.079	.883
	Gender	—	—	—	—	—	**−.307**	**.086**	**−.475**	**−.139**	**< .001**
Model 5: Agreeableness subfacets	Compassion	.006	.056	−.104	.116	.915	.046	.057	−.065	.157	.418
	Respectfulness	**.129**	**.054**	**.024**	**.235**	**.016**	.102	.051	.001	.203	.048
	Trust	−.014	.051	−.115	.086	.778	−.015	.049	−.112	.082	.760
	GPA	—	—	—	—	—	**.261**	**.047**	**.169**	**.353**	**< .001**
	Reasoning ability	—	—	—	—	—	−.031	.045	−.119	.056	.481
	Gender	—	—	—	—	—	**−.320**	**.093**	**−.502**	**−.137**	**< .001**
Model 6: Negative emotionality subfacets	Anxiety	.088	.052	−.014	.191	.090	.063	.053	−.068	.167	.235
	Depression	**−.324**	**.050**	**−.421**	**−.227**	**< .001**	**−.305**	**.049**	**−.400**	**−.209**	**< .001**
	Emotional volatility	−.071	.047	−.163	.021	.130	−.030	.046	−.120	.061	.523
	GPA	—	—	—	—	—	**.209**	**.045**	**.121**	**.298**	**< .001**
	Reasoning ability	—	—	—	—	—	.007	.042	−.075	.090	.868
	Gender	—	—	—	—	—	−.131	.088	−.303	.042	.137

Note. Data displayed in this table are based on 250 students and 5,282 observations (models with covariates: 240 students and 5,040 observations). Coefficient estimates are standardized betas (β). CI = confidence interval; LL = lower limit; UL = upper limit; GPA = grade point average. Values in bold typeface remained statistically significant after Holm–Bonferroni correction.
[a] Unadjusted *p* values.

variability in state general-school ASC (see Table 4). The positive relation between depression (negative emotionality) and variability in state general-school ASC remained stable when covariates were included in the analyses (see Table 4).

Discussion

The purpose of the present research was to explore between-person differences in students' mean level and within-person variability in state ASC to gain an enhanced understanding of the nature and potential antecedents of ASC over time. We focused on state general-school ASC among German secondary school students, using intensive longitudinal data obtained through experience sampling to investigate variation from school lesson to school lesson. To the best of our knowledge, this is the first study to explore momentary state ASC and its lesson-to-lesson variation by taking a closer look at personality traits (i.e., the Big Five) as sources of between-person differences in students' level and variability in state ASC. In addition to investigating the Big Five domains, we took a new approach to explaining the relation between personality traits and ASC by further investigating ASC's nomological network in terms of the 15 Big Five subfacets. By applying MELS (Hedeker et al., 2008; Hedeker & Nordgren, 2013), we were able to simultaneously model level and variability in state ASC, which allowed us to control for the effects

Table 4

Mixed-Effects Location Scale Model With Personality Predicting Within-Person Variability in State General-School Academic Self-Concept

		State general-school academic self-concept									
		Variability (without covariates)					Variability (with covariates)				
				95% CI					95% CI		
Model	Variable	Estimate	*SE*	LL	UL	*p*[a]	Estimate	*SE*	LL	UL	*p*[a]
Model 1: Big Five domains	Open-mindedness	−.145	.115	−.370	.080	.206	−.135	.114	−.359	.009	.237
	Conscientiousness	.032	.121	−.206	.270	.793	.040	.128	−.210	.291	.752
	Extraversion	−.014	.118	−.245	.218	.908	−.040	.118	−.272	.192	.738
	Agreeableness	−.106	.121	−.343	.130	.378	−.142	.125	−.389	.102	.253
	Negative emotionality	.124	.124	−.120	.368	.319	.102	.137	−.166	.370	.454
	GPA	—	—	—	—	—	−.107	.130	−.362	.147	.409
	Reasoning ability	—	—	—	—	—	−.261	.119	−.495	−.028	.028
	Gender	—	—	—	—	—	.198	.272	−.335	.732	.466
Model 2: Open-mindedness subfacets	Aesthetic sensitivity	−.010	.127	−.259	.238	.936	−.109	.135	−.374	.155	.417
	Intellectual curiosity	−.164	.124	−.406	.078	.184	−.025	.127	−.274	.224	.846
	Creative imagination	−.047	.126	−.294	.200	.709	−.066	.124	−.309	.176	.591
	GPA	—	—	—	—	—	−.135	.123	−.379	.109	.277
	Reasoning ability	—	—	—	—	—	−.227	.117	−.456	.002	.052
	Gender	—	—	—	—	—	.224	.255	−.275	.723	.378
Model 3: Conscientiousness subfacets	Organization	.286	.133	.024	.547	.032	.281	.133	.020	.542	.035
	Productiveness	−.138	.135	−.404	.127	.308	−.175	.137	−.443	.093	.201
	Responsibility	−.243	.136	−.510	.029	.073	−.178	.138	−.450	.094	.199
	GPA	—	—	—	—	—	−.100	.130	−.254	.154	.439
	Reasoning ability	—	—	—	—	—	−.241	.117	−.476	−.018	.039
	Gender	—	—	—	—	—	.091	.242	−.384	.565	.708
Model 4: Extraversion subfacets	Sociability	.014	.147	−.273	.301	.925	.003	.146	−.282	.289	.981
	Assertiveness	.107	.137	−.162	.377	.434	.104	.134	−.158	.365	.438
	Energy level	−.232	.139	−.504	.039	.094	−.245	.141	−.420	.031	.082
	GPA	—	—	—	—	—	−.108	.125	−.352	.136	.387
	Reasoning ability	—	—	—	—	—	−.276	.118	−.507	−.045	.019
	Gender	—	—	—	—	—	.210	.235	−.249	.670	.370
Model 5: Agreeableness subfacets	Compassion	−.064	.149	−.357	.228	.667	−.133	.150	−.427	.162	.378
	Respectfulness	−.150	.139	−.422	.121	.278	−.140	.135	−.404	.125	.301
	Trust	.025	.134	−.239	.289	.852	.038	.130	−.218	.293	.773
	GPA	—	—	—	—	—	−.105	.122	−.345	.135	.390
	Reasoning ability	—	—	—	—	—	−.261	.116	−.490	−.033	.025
	Gender	—	—	—	—	—	.281	.246	−.200	.763	.252
Model 6: Negative emotionality subfacets	Anxiety	−.272	.142	−.551	.006	.055	−.278	.145	−.561	.008	.056
	Depression	**.325**	**.134**	**.062**	**.588**	**.016**	**.365**	**.133**	**.104**	**.626**	**.006**
	Emotional volatility	.119	.127	−.132	.369	.348	.095	.126	−.153	.343	.454
	GPA	—	—	—	—	—	−.040	.125	−.286	.205	.747
	Reasoning ability	—	—	—	—	—	−.283	.117	−.511	−.054	.015
	Gender	—	—	—	—	—	.119	.244	−.360	.597	.627

Note. Data displayed in this table are based on 250 students and 5,282 observations (models with covariates: 240 students and 5,040 observations). Coefficient estimates are standardized betas (β). CI = confidence interval; LL = lower limit; UL = upper limit; GPA = grade point average. Values in bold typeface remained statistically significant after Holm–Bonferroni correction.

[a] Unadjusted *p* values.

of students' levels of state ASC on variability in state ASC and vice versa while also accounting for temporal trends as well as covariates (i.e., GPA, reasoning ability, and gender), thus extending previous research.

Students' Personality Relates to Everyday Dynamics in ASC

While ASC is generally assumed to be a stable personal characteristic across intervals of several months or even years (i.e., trait; Jansen et al., 2020), our results provide strong evidence for short-term variability

in ASC, suggesting that even general-school ASC entails both a trait and a state component. This contrasts the seminal conceptualization of ASC by Shavelson et al. (1976), who considered general-school ASC as most stable. The large majority of students investigated in the present study showed intraindividual variability in their ASC. Thus, their ASC fluctuated over time: Even if students reported a lower ASC in one lesson, there were still lessons in which they felt more competent; conversely, even students who typically reported higher levels of ASC sometimes perceived their academic abilities to be lower. This study thus provides first insights into ASC dynamics, in line with previous studies conceptually describing that self-concept entails both stable

Table 5
Mixed-Effects Location Scale Model With Personality Predicting State General-School Academic Self-Concept: Model Fit

	State general-school academic self-concept			
	Without covariates		With covariates	
Model	AIC	BIC	AIC	BIC
Model 1: Big Five domains	1,781.424	1,841.289	1,442.711	1,522.766
Model 2: Open-mindedness subfacets	1,811.835	1,857.614	1,471.719	1,537.851
Model 3: Conscientiousness subfacets	1,800.902	1,846.681	1,464.362	1,530.494
Model 4: Extraversion subfacets	1,813.346	1,859.125	1,466.723	1,532.855
Model 5: Agreeableness subfacets	1,832.531	1,878.310	1,484.809	1,550.941
Model 6: Negative emotionality subfacets	1,785.295	1,831.074	1,446.834	1,512.966

Note. AIC = Akaike's information criterion; BIC = Bayesian information criterion.

and variable—and thus malleable—components (e.g., O'Mara et al., 2006; Shavelson et al., 1976; see also Niepel et al., 2021).

Additionally, our findings suggest that the broad Big Five domains of open-mindedness, conscientiousness, and negative emotionality were associated with students' levels of state general-school ASC. These associations remained when controlling for GPA, reasoning ability, and gender, and an additional relation with the broad domain of extraversion emerged. Our results thus suggest that, independent of GPA, reasoning ability, and gender, students who are more open-minded, conscientious, and extraverted but less neurotic (i.e., negative emotionality) seemed to perceive their abilities in academic contexts as higher across several weeks. These findings mostly correspond to previous research on the associations between Big Five traits and trait-level ASC (Jonkmann et al., 2012; Marsh et al., 2006; Shafer, 2000).

When zooming in on the Big Five subfacet level, we found at least one subfacet of each Big Five domain to be associated with levels of state general-school ASC, independent of GPA, reasoning ability, and gender. Our findings imply that students with higher intellectual curiosity and creative imagination (open-mindedness) as well as more productive and responsible (conscientiousness), more assertive and energetic (extraversion), more respectful (agreeableness), and less depressive (negative emotionality) tendencies appeared to perceive a higher level of state general-school ASC.

Regarding variability in state ASC, we found that none of the broad Big Five domains were related to variability in state general-school ASC. However, ours is the first study to find one of the Big Five subfacets to be associated with variability in state general-school ASC. The subfacet depression (negative emotionality) was associated with greater variability in state general-school ASC, suggesting that students with the propensity to be more depressed seemed to experience greater variability in state general-school ASC across time. This association with the depression subfacet remained significant after controlling for students' GPA, reasoning ability, and gender. Thus, more depressed students seemed to experience their academic abilities as more variable. Previous research on the associations between trait Big Five domains and variability in state self-esteem (conceptually related to ASC; see, e.g., Marsh, Seaton, et al., 2019) are in line with this finding as they had found increased variability in self-esteem among individuals reporting higher negative emotionality

(Geukes, Nestler, Hutteman, Küfner, & Back, 2017; Meier et al., 2011; Zeigler-Hill et al., 2015).

The identification of personality as a potential antecedent of momentary state ASC and its variation thus advances the theoretical understanding of ASC formation. That is, how stable students perceive their academic abilities to be seems to be tied to specific aspects of students' personality. The tendency to be more depressed seems to affect students' ASC formation to the extent that they not only have an overall lower ASC but also experience greater fluctuations in their perceived competence from school lesson to school lesson. The negative effects of low levels of trait ASC for education and learning are well known (for a review, see Trautwein & Möller, 2016); however, less is known about the meaning of greater variability in state ASC when navigating everyday school life. Based on previous research on intraindividual variability in trait self-representations in adolescents (i.e., global self-esteem, physical self-concept, domain-specific ASCs; see review by Gest et al., 2015), we propose that the greater variability in state ASC we found among more depressed students may reflect a form of vulnerability and thus may be an indicator of maladaptive psychological functioning. This would also be in line with findings by Molloy et al. (2011), who reported that greater variability in trait ASC is associated with overall lower academic adjustment (i.e., academic self-concept, teacher-rated academic skills, and peer academic reputation) and poorer mental health (i.e., general self-worth, loneliness, peer victimization, and teacher-rated attention) in adolescent students. They concluded that instability in students' ASC may be indicative of less coherent and self-assured perceptions of their academic abilities, which may result in inconsistent endeavor or even avoidance of challenges necessary to build academic skills. Correspondingly, more depressed students appear to have a rather weak sense of self with more variable self-concepts, which may be indicative of them being more sensitive to varying feedback, less adaptive to changing situational demands, and less self-assured regarding the challenges they can effectively tackle, potentially leading to disadvantages for these students in academic contexts (Gest et al., 2015; Molloy et al., 2011).

However, more recent research exploring variability in a range of socioaffective variables suggests that the nature of variability may be potentially twofold. Hence, greater within-person variability in state ASC might not exclusively indicate maladaptive psychological functioning but could additionally be indicative of flexibility or the ability to respond flexibly to changing circumstances and thus also be a marker of adaptive psychological

functioning (Kashdan & Rottenberg, 2010; MacDonald & Stawski, 2015; Peng et al., 2015). Accordingly, greater variability in students' ASC could in principle also reflect a healthy adaptive process in which students tend to adjust their academic competence beliefs in response to contradicting feedback or difficulties they have encountered in maintaining their typical level of ASC, which could pave the way for successful interactions with their environment (Gest et al., 2015). Nonetheless, our finding of greater variability in state general-school ASC in more depressed students appears to be more in line with empirical evidence from previous (trait) ASC research (e.g., Molloy et al., 2011) supporting the view that fluctuations in ASC reflect a form of vulnerability as individuals with more variable self-concepts appear to be more sensitive to varying feedback than individuals with stable self-views (Dweck, 2002; Gest et al., 2015; Molloy et al., 2011).

Big Five as Antecedents of ASC

The current study's findings further support the relevance of Big Five traits, which are increasingly considered as crucial for a range of life outcomes (for a review, see De Fruyt et al., 2017). In the educational context, Big Five traits have already been found to be substantially implicated in students' academic achievement, even independent of their cognitive abilities (Poropat, 2009; Vedel & Poropat, 2017). Likewise, our findings suggest that Big Five traits are important antecedents of one of the most important motivational variables in the academic context, namely ASC (i.e., state level and variability therein), even beyond students' reasoning ability and GPA. Students' personality thus seems to matter for the formation of their ASC and consequently for their ability to successfully navigate their everyday school life, highlighting the relevance of the Big Five as well as the importance of considering noncognitive traits in addition to cognitive abilities in educational research and contexts. However, it is important to note that while several predictive associations were shown between the Big Five domains and subfacets on the one hand and the level of state ASC on the other (as summarized above), only one of 15 subfacets (i.e., depression) showed a statistically significant association with within-person variability in ASC. Hence, future studies should replicate the presented findings and verify the extent to which Big Five traits are implicated in the formation of state ASC—especially with respect to its within-person variability.

Moreover, it proved fruitful to examine the more precise Big Five subfacets as predictors of state ASC in addition to the broader domains. In line with previous research positing incremental as well as differential value of the subfacet over the domain level (e.g., Danner et al., 2021), we not only found that all same-domain subfacets never predicted either level or variability in state general-school ASC, but we also found opposing relations with regard to subfacets of some domains (even if not all of these associations reached significance). Both of these points would have been obscured by only focusing on the broader Big Five domains (Model 1). Our findings thus confirm that facet-level research is necessary to achieve a full understanding of personality-related differences in state ASC and indeed allowed us to draw more fine-grained conclusions with respect to our research questions. However, it might still be worthwhile to dig deeper into the associations found to determine why some same-domain facets were significantly related to state ASC while others were not. Further

research is needed to replicate our findings and disentangle the differences between same-domain facets in order to resolve this issue.

Furthermore, the present findings support several lines of thought describing Big Five traits as basic tendencies that influence characteristic adaptations such as ASC (e.g., Asendorpf & van Aken, 2003; McAdams & Pals, 2006; McCrae & Costa, 2008). However, even though our study design implied causality, we are unable to ultimately determine it and thus cannot exclude potential reciprocal relations between Big Five traits and characteristic adaptations, as have recently been found with respect to self-esteem (Weidmann et al., 2018). This is a topic for further study.

Importantly, the presented findings highlight that exclusively considering between-person differences in levels of ASC might disguise the differentiated effects of personality on between-person differences in mean level and within-person variability in state ASC. Intraindividual variability offers additional insights into how individuals differ from each other above and beyond their interindividual mean differences (Fleeson, 2004; Nesselroade & Ram, 2004; Ram & Gerstorf, 2009). Consequently, our empirical evidence suggests that an integrated view considering both level and variability is more informative and further highlights the need to integrate state ASC into our current theoretical understanding of ASC.

Implications

Our findings have important implications for educational research. The present results suggest that the theoretical conceptualization of ASC as a state should be taken more strongly into account in future research. Furthermore, we have shown that ASC is indeed malleable, underscoring the potential utility of interventions aimed at improving students' ASC (e.g., O'Mara et al., 2006).

Moreover, determining antecedents of ASC makes it possible to more reliably predict whether students will do well in academic contexts. Thus far, conscientiousness had been established as the most relevant Big Five personality trait for learning and academic achievement (e.g., Poropat, 2009). The present study additionally suggests negative emotionality and especially its subfacet depression to be involved in the formation of students' ASC from school lesson to school lesson. Strategies and interventions designed to enhance students' ASC might therefore also consider how to adaptively deal with ASC fluctuations in students with certain personality features in order to counteract the potential detrimental consequences of ASC variability on educational outcomes above and beyond the negative effects of low levels of trait ASC (see, e.g., Trautwein & Möller, 2016) in order to create supportive and equal academic environments for student learning and subsequent academic success. Further research will be necessary to clarify the mechanism(s) explaining the observed positive association between depression and variability in state ASC and to consider additional explanations for the observed variability in state ASC.

Limitations

Although this study provides valuable insights into the everyday dynamics of students' state ASC, it is also important to acknowledge

some of its limitations, which point to multiple fruitful directions for future research. First, although our study design implied certain temporal dynamics in students' state ASC, it does not allow for causal inferences on the relation between students' personality and their experienced state ASC. Furthermore, future research might wish to replicate our initial findings by additionally investigating the link between personality states (Fleeson, 2001) and state ASC. Moreover, future research should consider a more sophisticated multilevel model considering that the classroom- and school-specific environment may affect students' ASC formation as well. The generalizability of the present findings may be somewhat limited due to our focus on state general-school ASC in adolescent secondary school students attending the highest track of the German school system (i.e., 44% of all German students attend Gymnasium; Autorengruppe Bildungsberichterstattung, 2018, p. 94). Further, our sample is a convenient sample that is not representative for the German secondary school population attending the highest track (i.e., Gymnasium). As such, we observed that young men are slightly underrepresented (in comparison to data from the Federal Statistical Office of Germany; Statistisches Bundesamt, 2021). Moreover, we could not rule out that students were absent from school (i.e., cut school) because of low ASC or that absences were related to specific personality traits, both of which could potentially introduce some bias to our findings. Thus, it would be helpful for future studies to extend the presented results and test for generalizability among different student populations, school types, gender, and age groups, as well as to collect more detailed information on the reasons for students' absence from school. Furthermore, our results imply small- to medium-sized effects, and we have found only one of the 15 Big Five subfacets (i.e., depression) to be significantly associated with within-person variability in state ASC. Thus, the present study merely lays a foundation for future work to explain further variance in intraindividual variability in state ASC. Finally, our findings indicate that greater state ASC variability in more depressed students reflects responsiveness to changing contexts as a marker of poor adjustment and adaptability (i.e., maladaptiveness; MacDonald & Stawski, 2015). Future research is necessary to replicate these exploratory findings by conducting even more detailed analyses of potential determinants and consequences of intraindividual variability in state ASC on the one hand and of the processes underlying the relationship between personality features and state ASC on the other hand.

Conclusions

The present research provides first evidence that students' general-school ASC undergoes short-term fluctuations from school lesson to school lesson and that this intraindividual variability can be partly explained by students' personality. Our findings suggest that several domains and subfacets of the Big Five personality traits are predictors of students' momentary (state) mean level of self-concept and one Big Five subfacet (i.e., depression) of students' within-person variability, thus helping to provide a more complete understanding of the dynamic nature of state ASC and the role of personality. As such, the present research also emphasizes the relevance of personality as a set of noncognitive traits for students' daily academic motivation. These findings thus extend our theoretical understanding of ASC as one of the most important motivational factors in educational contexts (Marsh, Seaton, et al., 2019; Pintrich, 2003; Trautwein & Möller, 2016) and suggest that

researchers move beyond focusing solely on ASC at the trait level to also consider ASC at the state level.

References

Almlund, M., Duckworth, A. L., Heckman, J., & Kautz, T. (2011). Personality psychology and economics. In E. A. Hanushek, S. Machin, & L. Woessmann (Eds.), *Handbook of the economics of education* (Vol. 4, pp. 1–181). Elsevier. https://doi.org/10.1016/B978-0-444-53444-6.00001-8

Arens, A. K., Jansen, M., Preckel, F., Schmidt, I., & Brunner, M. (2021). The structure of academic self-concept: A methodological review and empirical illustration of central models. *Review of Educational Research*, *91*(1), 34–72. https://doi.org/10.3102/0034654320972186

Asendorpf, J. B., & Motti-Stefanidi, F. (2017). Mediated disposition-environment transactions: The DAE model. *European Journal of Personality*, *32*(3), 167–185. https://doi.org/10.1002/per.2118

Asendorpf, J. B., & van Aken, M. A. G. (2003). Personality-relationship transaction in adolescence: Core versus surface personality characteristics. *Journal of Personality*, *71*(4), 629–666. https://doi.org/10.1111/1467-6494.7104005

Autorengruppe Bildungsberichterstattung. (2018). *Bildung in Deutschland 2018: Ein indikatorengestützter Bericht mit einer Analyse zu Wirkungen und Erträgen von Bildung* [Education in Germany 2018: An indicator-based report with an analysis on the effects and gains of education]. https://www.bildungsbericht.de/de/bildungsberichte-seit-2006/bildungsbericht-2018/pdf-bildungsbericht-2018/bildungsbericht-2018.pdf

Baird, B. M., Le, K., & Lucas, R. E. (2006). On the nature of intraindividual personality variability: Reliability, validity, and associations with well-being. *Journal of Personality and Social Psychology*, *90*(3), 512–527. https://doi.org/10.1037/0022-3514.90.3.512

Bartels, M., van Weegen, F. I., van Beijsterveldt, C. E. M., Carlier, M., Polderman, T. J. C., Hoekstra, R. A., & Boomsma, D. I. (2012). The five factor model of personality and intelligence: A twin study on the relationship between the two constructs. *Personality and Individual Differences*, *53*(4), 368–373. https://doi.org/10.1016/j.paid.2012.02.007

Brunner, M., Lüdtke, O., & Trautwein, U. (2008). The internal/external frame of reference model revisited: Incorporating general cognitive ability and general academic self-concept. *Multivariate Behavioral Research*, *43*(1), 137–172. https://doi.org/10.1080/00273170701836737

Byrne, B. M. (2002). Validating the measurement and structure of self-concept: Snapshots of past, present, and future research. *American Psychologist*, *57*(11), 897–909. https://doi.org/10.1037/0003-066X.57.11.897

Chen, S.-K., Hwang, F.-M., Yeh, Y.-C., & Lin, S. S. J. (2012). Cognitive ability, academic achievement and academic self-concept: Extending the internal/external frame of reference model. *British Journal of Educational Psychology*, *82*(Pt. 2), 308–326. https://doi.org/10.1111/j.2044-8279.2011.02027.x

Chernyshenko, O., Kankaraš, M., & Drasgow, F. (2018). *Social and emotional skills for student success and well-being: Conceptual framework for the OECD Study on Social and Emotional Skills* (OECD Education Working Papers No. 173). https://doi.org/10.1787/db1d8e59-en

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Erlbaum.

Cole, D. A., Maxwell, S. E., Martin, J. M., Peeke, L. G., Seroczynski, A. D., Tram, J. M., Hoffman, K. B., Ruiz, M. D., Jacquez, F., & Maschman, T. (2001). The development of multiple domains of child and adolescent self-concept: A cohort sequential longitudinal design. *Child Development*, *72*(6), 1723–1746. https://doi.org/10.1111/1467-8624.00375

Cumming, G. (2014). The new statistics: Why and how. *Psychological Science*, *25*(1), 7–29. https://doi.org/10.1177/0956797613504966

Danner, D., Lechner, C. M., Soto, C. J., & John, O. P. (2021). Modelling the incremental value of personality facets: The domains-incremental

facets-acquiescence bifactor model. *European Journal of Personality*, *35*(1), 67–84. https://doi.org/10.1002/per.2268

Danner, D., Rammstedt, B., Bluemke, M., Lechner, C., Berres, S., Knopf, T., Soto, C. J., & John, O. P. (2019). Das Big Five Inventar 2: Validierung eines Persönlichkeitsinventars zur Erfassung von 5 Persönlichkeitsdomänen und 15 Facetten [The German Big Five Inventory 2: Measuring five personality domains and 15 facets]. *Diagnostica*, *65*(3), 121–132. https://doi.org/10.1026/0012-1924/a000218

De Fruyt, F., De Clercq, B., & De Bolle, M. (2017). The five factor model of personality and consequential outcomes in childhood and adolescence. In T. A. Widiger (Ed.), *The Oxford handbook of the five factor model* (pp. 507–520). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199352487.013.6

Dickhäuser, O., & Plenter, I. (2005). "Letztes Halbjahr stand ich zwei." Zur Akkuratheit selbst berichteter Noten ["Last term I had a B." On the accuracy of self-reported school marks]. *Zeitschrift für Pädagogische Psychologie/German Journal of Educational Psychology*, *19*(4), 219–224. https://doi.org/10.1024/1010-0652.19.4.219

Dörendahl, J., Scherer, R., Greiff, S., & Niepel, C. (2021). Dimensional comparisons in the formation of domain-specific achievement goals. *Motivation Science*, *7*(3), 306–318. https://doi.org/10.1037/mot0000203

Dweck, C. (2002). The development of ability conceptions. In A. Wigfield & J. S. Eccles (Eds.), *Development of achievement motivation* (pp. 57–88). Academic Press. https://doi.org/10.1016/B978-012750053-9/50005-X

Dzubur, E., Ponnada, A., Nordgren, R., Yang, C.-H., Intille, S., Dunton, G., & Hedeker, D. (2020). MixWILD: A program for examining the effects of variance and slope of time-varying variables in intensive longitudinal data. *Behavior Research Methods*, *52*(4), 1403–1427. https://doi.org/10.3758/s13428-019-01322-1

Fahrenberg, J., Myrtek, M., Pawlik, K., & Perrez, M. (2007). Ambulatory assessment – Monitoring behaviour in daily life settings. *European Journal of Psychological Assessment*, *23*(4), 206–213. https://doi.org/10.1027/1015-5759.23.4.206

Fleeson, W. (2001). Toward a structure- and process-integrated view of personality: Traits as density distribution of states. *Journal of Personality and Social Psychology*, *80*(6), 1011–1027. https://doi.org/10.1037/0022-3514.80.6.1011

Fleeson, W. (2004). Moving personality beyond the person-situation debate: The challenge and the opportunity of within-person variability. *Current Directions in Psychological Science*, *13*(2), 83–87. https://doi.org/10.1111/j.0963-7214.2004.00280.x

Geldhof, G. J., Preacher, K. J., & Zyphur, M. J. (2014). Reliability estimation in a multilevel confirmatory factor analysis framework. *Psychological Methods*, *19*(1), 72–91. https://doi.org/10.1037/a0032138

Gest, S. D., Molloy, L. E., & Ram, N. (2015). Intraindividual variability in self-representations in adolescence. In M. Diehl, K. Hooker, & M. J. Sliwinski (Eds.), *Handbook of intraindividual variability across the life span* (pp. 123–141). Routledge.

Geukes, K., Nestler, S., Hutteman, R., Dufner, M., Küfner, A. C. P., Egloff, B., Denissen, J. J. A., & Back, M. D. (2017). Puffed-up but shaky selves: State self-esteem level and variability in narcissists. *Journal of Personality and Social Psychology*, *112*(5), 769–786. https://doi.org/10.1037/pspp0000093

Geukes, K., Nestler, S., Hutteman, R., Küfner, A. C. P., & Back, M. D. (2017). Trait personality and state variability: Predicting individual differences in within- and cross-context fluctuations in affect, self-evaluations, and behavior in everyday life. *Journal of Research in Personality*, *69*, 124–138. https://doi.org/10.1016/j.jrp.2016.06.003

Gogol, K., Brunner, M., Goetz, T., Martin, R., Ugen, S., Keller, U., Fischbach, A., & Preckel, F. (2014). "My questionnaire is too long!" The assessments of motivational-affective constructs with three-item and single-item measures. *Contemporary Educational Psychology*, *39*(3), 188–205. https://doi.org/10.1016/j.cedpsych.2014.04.002

Gogol, K., Brunner, M., Preckel, F., Goetz, T., & Martin, R. (2016). Developmental dynamics of general and school-subject-specific components of academic self-concept, academic interest, and academic anxiety. *Frontiers in Psychology*, *7*, Article 356. https://doi.org/10.3389/fpsyg.2016.00356

Guo, J., Marsh, H. W., Parker, P., Morin, A. J. S., & Dicke, T. (2017). Extending expectancy-value theory predictions of achievement and aspirations in science: Dimensional comparison processes and expectancy-by-value interactions. *Learning and Instruction*, *49*, 81–91. https://doi.org/10.1016/j.learninstruc.2016.12.007

Guo, J., Parker, P. D., Marsh, H. W., & Morin, A. J. S. (2015). Achievement, motivation, and educational choices: A longitudinal study of expectancy and value using a multiplicative perspective. *Developmental Psychology*, *51*(8), 1163–1176. https://doi.org/10.1037/a0039440

Harter, S., & Whitesell, N. R. (2003). Beyond the debate: Why some adolescents report stable self-worth over time and situation, whereas others report changes in self-worth. *Journal of Personality*, *71*(6), 1027–1058. https://doi.org/10.1111/1467-6494.7106006

Hedeker, D., Mermelstein, R. J., & Demirtas, H. (2008). An application of a mixed-effects location scale model for analysis of ecological momentary assessment (EMA) data. *Biometrics*, *64*(2), 627–634. https://doi.org/10.1111/j.1541-0420.2007.00924.x

Hedeker, D., & Nordgren, R. (2013). MIXREGLS: A program for mixed-effects location scale analysis. *Journal of Statistical Software*, *52*(12), 1–38. https://doi.org/10.18637/jss.v052.i12

Holm, S. (1979). A simple sequentially rejective multiple test procedure. *Scandinavian Journal of Statistics*, *6*, 65–70. http://www.jstor.org/stable/4615733

Hox, J. J., Moerbeek, M., & Van de Schoot, R. (2017). *Multilevel analysis: Techniques and applications* (3rd ed.). Routledge. https://doi.org/10.4324/9781315650982

Huisingh-Scheetz, M., Wroblewski, K., Waite, L., Huang, E. S., Schumm, L. P., & Hedeker, D. (2020). Variability in hourly activity levels: Statistical noise or insight into older adult frailty? *The Journals of Gerontology: Series A*, *76*(9), 1608–1618. https://doi.org/10.1093/gerona/glaa262

Jansen, M., Lüdtke, O., & Robitzsch, A. (2020). Disentangling different sources of stability and change in students' academic self-concepts: An integrative data analysis using the STARTS model. *Journal of Educational Psychology*, *112*(8), 1614–1631. https://doi.org/10.1037/edu0000448

John, O. P. (2021). History, measurement, and conceptual elaboration of the Big-Five trait taxonomy: The paradigm matures. In O. P. John & R. W. Robins (Eds.), *Handbook of personality: Theory and research* (4th ed., pp. 35–82). Guilford Press.

Jonkmann, K., Becker, M., Marsh, H. W., Lüdtke, O., & Trautwein, U. (2012). Personality traits moderate the big-fish–little-pond effect of academic self-concept. *Learning and Individual Differences*, *22*(6), 736–746. https://doi.org/10.1016/j.lindif.2012.07.020

Kandler, C., Zimmermann, J., & McAdams, D. P. (2014). Core and surface characteristics for the description and theory of personality differences and development. *European Journal of Personality*, *28*(3), 231–243. https://doi.org/10.1002/per.1952

Kaplan, D. (2009). *Structural equation modeling: Foundations and extensions* (2nd ed.). Sage. https://doi.org/10.4135/9781452226576

Kashdan, T. B., & Rottenberg, J. (2010). Psychological flexibility as a fundamental aspect of health. *Clinical Psychology Review*, *30*(7), 865–878. https://doi.org/10.1016/j.cpr.2010.03.001

Kernis, M. H. (2005). Measuring self-esteem in context: The importance of stability of self-esteem in psychological functioning. *Journal of Personality*, *73*(6), 1569–1605. https://doi.org/10.1111/j.1467-6494.2005.00359.x

Kim, E. S., Dedrick, R. F., Cao, C., & Ferron, J. M. (2016). Multilevel factor analysis: Reporting guidelines and a review of reporting practices. *Multivariate Behavioral Research*, *51*(6), 881–898. https://doi.org/10.1080/00273171.2016.1228042

Kozina, A. (2019). The development of multiple domains of self-concept in late childhood and in early adolescence. *Current Psychology*, *38*(6), 1435–1442. https://doi.org/10.1007/s12144-017-9690-9

Križan, Z., & Hisler, G. (2019). Personality and sleep: Neuroticism and conscientiousness predict behaviourally recorded sleep years later. *European Journal of Personality*, *33*(2), 133–153. https://doi.org/10.1002/per.2191

Liepmann, D., Beauducel, A., Brocke, B., & Nettelnstroth, W. (2012). *Intelligenz-Struktur-Test-Screening* [Intelligence Structure Test-Screening]. Hogrefe.

Little, R. J. A., & Rubin, D. B. (2002). *Statistical analysis with missing data* (2nd ed.). Wiley. https://doi.org/10.1002/9781119013563

MacDonald, S. W. S., & Stawski, R. S. (2015). Intraindividual variability–-An indicator of vulnerability or resilience in adult development and aging? In M. Diehl, K. Hooker, & M. J. Sliwinski (Eds.), *Handbook of intraindividual variability across the life span* (pp. 231–257). Routledge.

Marsh, H. W., Pekrun, R., Parker, P. D., Murayama, K., Guo, J., Dicke, T., & Arens, A. K. (2019). The murky distinction between self-concept and self-efficacy: Beware of lurking jingle-jangle fallacies. *Journal of Educational Psychology*, *111*(2), 331–353. https://doi.org/10.1037/edu0000281

Marsh, H. W., Relich, J. D., & Smith, I. D. (1983). Self-concept: The construct validity of interpretations based upon the SDQ. *Journal of Personality and Social Psychology*, *45*(1), 173–187. https://doi.org/10.1037/0022-3514.45.1.173

Marsh, H. W., Seaton, M., Dicke, T., Parker, P. D., & Horwood, M. S. (2019). The centrality of academic self-concept to motivation and learning. In K. A. Renninger & S. E. Hidi (Eds.), *The Cambridge handbook of motivation and learning* (pp. 36–62). Cambridge University Press. https://doi.org/10.1017/9781316823279.004

Marsh, H. W., & Shavelson, R. (1985). Self-concept: Its multifaceted, hierarchical structure. *Educational Psychologist*, *20*(3), 107–123. https://doi.org/10.1207/s15326985ep2003_1

Marsh, H. W., Trautwein, U., Lüdtke, O., Köller, O., & Baumert, J. (2005). Academic self-concept, interest, grades, and standardized test scores: Reciprocal effects models of causal ordering. *Child Development*, *76*(2), 397–416. https://doi.org/10.1111/j.1467-8624.2005.00853.x

Marsh, H. W., Trautwein, U., Lüdtke, O., Köller, O., & Baumert, J. (2006). Integration of multidimensional self-concept and core personality constructs: Construct validation and relations to well-being and achievement. *Journal of Personality*, *74*(2), 403–456. https://doi.org/10.1111/j.1467-6494.2005.00380.x

Marsh, H. W., & Yeung, A. S. (1998). Top-down, bottom-up, and horizontal models: The direction of causality in multidimensional, hierarchical self-concept models. *Journal of Personality and Social Psychology*, *75*(2), 509–527. https://doi.org/10.1037/0022-3514.75.2.509

McAdams, D. P., & Pals, J. L. (2006). A new Big Five: Fundamental principles for an integrative science of personality. *American Psychologist*, *61*(3), 204–217. https://doi.org/10.1037/0003-066X.61.3.204

McCrae, R. R., & Costa, P. T., Jr. (2008). The five-factor theory of personality. In O. P. John, R. W. Robins, & L. A. Pervin (Eds.), *Handbook of personality: Theory and research* (3rd ed., pp. 159–181). Guilford Press.

Meier, L. M., Orth, U., Denissen, J. J. A., & Kühnel, A. (2011). Age differences in instability, contingency, and level of self-esteem across the life span. *Journal of Research in Personality*, *45*(6), 604–612. https://doi.org/10.1016/j.jrp.2011.08.008

Möller, J., Zitzmann, S., Helm, F., Machts, N., & Wolff, F. (2020). A meta-analysis of relations between achievement and self-concept. *Review of Educational Research*, *90*(3), 376–419. https://doi.org/10.3102/0034654320919354

Molloy, L. E., Ram, N., & Gest, S. D. (2011). The storm and stress (or calm) of early adolescent self-concepts: Within- and between-subjects variability. *Developmental Psychology*, *47*(6), 1589–1607. https://doi.org/10.1037/a0025413

Movisens GmbH. (2017). movisensXS (Version 1.3.0–1.3.4) [Mobile app]. https://www.movisens.com

Muthén, L. K., & Muthén, B. O. (1998–2017). Mplus (Version 8.3) [Computer software]. https://www.statmodel.com

Nagy, G., Trautwein, U., Baumert, J., Köller, O., & Garrett, J. (2006). Gender and course selection in upper secondary education: Effects of academic self-concept and intrinsic value. *Educational Research and Evaluation*, *12*(4), 323–345. https://doi.org/10.1080/13803610600765687

Napolitano, C. M., Sewell, M. N., Yoon, H. J., Soto, C. J., & Roberts, B. W. (2021). Social, emotional, and behavioral skills: An integrative model of the skills associated with success during adolescence and across the life span. *Frontiers in Education*, *6*, Article 679561. https://doi.org/10.3389/feduc.2021.679561

Nesselroade, J. R., & Ram, N. (2004). Studying intraindividual variability: What we have learned that will help us understand lives in context. *Research in Human Development*, *1*(1), 9–29. https://doi.org/10.1207/s15427617rhd0101&2_3

Niepel, C., Brunner, M., & Preckel, F. (2014). Achievement goals, academic self-concept, and school grades in mathematics: Longitudinal reciprocal relations in above average ability secondary school students. *Contemporary Educational Psychology*, *39*(4), 301–313. https://doi.org/10.1016/j.cedpsych.2014.07.002

Niepel, C., Marsh, H. W., Guo, J., Pekrun, R., & Möller, J. (2021). Revealing dynamic relations between mathematics self-concept and perceived achievement from lesson to lesson: An experience-sampling study. *Journal of Educational Psychology*, Advance online publication. https://doi.org/10.1037/edu0000716

Niepel, C., Stadler, M., & Greiff, S. (2019). Seeing is believing: Gender diversity in STEM is related to mathematics self-concept. *Journal of Educational Psychology*, *111*(6), 1119–1130. https://doi.org/10.1037/edu0000340

Nikolašević, Ž., Dinić, B. M., Smederevac, S., Sadiković, S., Milovanović, I., Ignjatović, V. B., & Bosić, D. Z. (2021). Common genetic basis of the five factor model facets and intelligence: A twin study. *Personality and Individual Differences*, *175*, Article 110682. https://doi.org/10.1016/j.paid.2021.110682

O'Mara, A. J., Marsh, H. W., Craven, R. G., & Debus, R. L. (2006). Do self-concept interventions make a difference? A synergistic blend of construct validation and meta-analysis. *Educational Psychologist*, *41*(3), 181–206. https://doi.org/10.1207/s15326985ep4103_4

Parker, P. D., Van Zanden, B., & Parker, R. B. (2018). Girls get smart, boys get smug: Historical changes in gender differences in math, literacy, and academic social comparison and achievement. *Learning and Instruction*, *54*, 125–137. https://doi.org/10.1016/j.learninstruc.2017.09.002

Paunonen, S. V., & Ashton, M. C. (2001). Big Five factors and facets and the prediction of behavior. *Journal of Personality and Social Psychology*, *81*(3), 524–539. https://doi.org/10.1037/0022-3514.81.3.524

Peng, A. C., Schaubroeck, J. M., & Xie, J. L. (2015). When confidence comes and goes: How variation in self-efficacy moderates stressor-strain relationships. *Journal of Occupational Health Psychology*, *20*(3), 359–376. https://doi.org/10.1037/a0038588

Petermann, F. (2014). Klinische Untersuchungsverfahren: Intelligenz-Struktur-Test [Clinical test methods: Intelligence Structure Test]. *Zeitschrift für Psychiatrie, Psychologie und Psychotherapie*, *62*(3), 225–226. https://doi.org/10.1024/1661-4747/a000199

Pilarska, A. (2018). Big-Five personality and aspects of the self-concept: Variable- and person-centered approaches. *Personality and Individual Differences*, *127*, 107–113. https://doi.org/10.1016/j.paid.2018.01.049

Pintrich, P. R. (2003). Motivation and classroom learning. In W. M. Reynolds & G. E. Miller (Eds.), *Handbook of psychology: Vol. 7. Educational psychology* (pp. 102–122). Wiley.

Ployhart, R. E., & MacKenzie, W. I., Jr. (2014). Two waves of measurement do not a longitudinal study make. In C. E. Lance & R. J. Vandenberg (Eds.), *More statistical and methodological myths and urban legends* (pp. 85–99). Routledge. https://doi.org/10.4324/9780203775851

Podsakoff, N. P., Spoelma, T. M., Chawla, N., & Gabriel, A. S. (2019). What predicts within-person variance in applied psychology constructs? An empirical examination. *Journal of Applied Psychology*, *104*(6), 727–754. https://doi.org/10.1037/apl0000374

Poropat, A. E. (2009). A meta-analysis of the five-factor model of personality and academic performance. *Psychological Bulletin*, *135*(2), 322–338. https://doi.org/10.1037/a0014996

Ram, N., & Gerstorf, D. (2009). Time-structured and net intraindividual variability: Tools for examining the development of dynamic characteristics and processes. *Psychology and Aging*, *24*(4), 778–791. https://doi.org/10.1037/a0017915

Rauthmann, J. F. (Ed.). (2021). Capturing interactions, correlations, fits, and transactions: A person-environment relations model. *Handbook of personality dynamics and processes* (pp. 427–522). Elsevier. https://doi.org/10.1016/B978-0-12-813995-0.00018-2

Shafer, A. B. (2000). Relation of the Big Five to biodata and aspects of the self. *Personality and Individual Differences*, *28*(6), 1017–1035. https://doi.org/10.1016/S0191-8869(99)00126-9

Shavelson, R. J., Hubner, J. J., & Stanton, G. C. (1976). Self-concept: Validation of construct interpretations. *Review of Educational Research*, *46*(3), 407–441. https://doi.org/10.3102/00346543046003407

Soto, C. J., & John, O. P. (2017). The next Big Five Inventory (BFI-2): Developing and assessing a hierarchical model with 15 facets to enhance bandwidth, fidelity, and predictive power. *Journal of Personality and Social Psychology*, *113*(1), 117–143. https://doi.org/10.1037/pspp0000096

Soto, C. J., John, O. P., Gosling, S. D., & Potter, J. (2011). Age differences in personality traits from 10 to 65: Big Five domains and facets in a large cross-sectional sample. *Journal of Personality and Social Psychology*, *100*(2), 330–348. https://doi.org/10.1037/a0021717

Sparfeldt, J. R., Buch, S. R., Rost, D. H., & Lehmann, G. (2008). Akkuratesse selbstberichteter Zensuren [The accuracy of self-reported grades in school]. *Psychologie in Erziehung Und Unterricht*, *55*(1), 68–75. https://psycnet.apa.org/record/2008-02500-007

Statistisches Bundesamt. (2021). *Schüler: Deutschland, Schuljahr, Geschlecht, Schulart, Jahrgangsstufen* [Pupils: Germany, school year, gender, school type, grades] [Data set]. https://www-genesis.destatis.de/genesis//online?operation=table&code=21111-0002&bypass=true&levelindex=1&levelid=1645626716977#abreadcrumb

Sticca, F., Goetz, T., Bieg, M., Hall, N. C., Eberle, F., & Haag, L. (2017). Examining the accuracy of students' self-reported academic grades from a correlational and a discrepancy perspective: Evidence from a longitudinal study. *PLoS ONE*, *12*(11), Article e0187367. https://doi.org/10.1371/journal.pone.0187367

Trautwein, U., Lüdtke, O., Köller, O., & Baumert, J. (2006). Self-esteem, academic self-concept, and achievement: How the learning environment moderates the dynamics of self-concept. *Journal of Personality and Social Psychology*, *90*(2), 334–349. https://doi.org/10.1037/0022-3514.90.2.334

Trautwein, U., Lüdtke, O., Schnyder, I., & Niggli, A. (2006). Predicting homework effort: Support for a domain-specific, multilevel homework model. *Journal of Educational Psychology*, *98*(2), 438–456. https://doi.org/10.1037/0022-0663.98.2.438

Trautwein, U., & Möller, J. (2016). Self-concept: Determinants and consequences of academic self-concept in school contexts. In A. A. Lipnevich, F. Preckel, & R. D. Roberts (Eds.), *Psychosocial skills and school systems in the 21st century: The Springer series on human exceptionality* (pp. 187–214). Springer International Publishing. https://doi.org/10.1007/978-3-319-28606-8_8

Trull, T. J., & Ebner-Priemer, U. (2013). Ambulatory assessment. *Annual Review of Clinical Psychology*, *9*, 151–176. https://doi.org/10.1146/annurev-clinpsy-050212-185510

Tsai, Y.-M., Kunter, M., Lüdtke, O., & Trautwein, U. (2008). Day-to-day variation in competence beliefs. How autonomy support predicts young adolescents' felt competence. In H. W. Marsh, R. G. Craven, & D. M. McInerney (Eds.), *Self-processes, learning, and enabling human potential* (pp. 119–143). Information Age Publishing.

Vedel, A., & Poropat, A. E. (2017). Personality and academic performance. In V. Zeigler-Hill & T. K. Shackelford (Eds.), *Encyclopedia of personality and individual differences* (pp. 1–9). Springer. https://doi.org/10.1007/978-3-319-28099-8_989-1

Wang, L. P., Hamaker, E., & Bergeman, C. S. (2012). Investigating interindividual differences in short-term intra-individual variability. *Psychological Methods*, *17*(4), 567–581. https://doi.org/10.1037/a0029317

Wang, L. P., & Maxwell, S. E. (2015). On disaggregating between-person and within-person effects with longitudinal data using multilevel models. *Psychological Methods*, *20*(1), 63–83. https://doi.org/10.1037/met0000030

Weidmann, R., Ledermann, T., Robins, R. W., Gomez, V., & Grob, A. (2018). The reciprocal link between the Big Five traits and self-esteem: Longitudinal associations within and between parents and their offspring. *Journal of Research in Personality*, *74*, 166–181. https://doi.org/10.1016/j.jrp.2018.04.003

Wilson, R. E., Thompson, R. J., & Vazire, S. (2017). Are fluctuations in personality states more than fluctuations in affect? *Journal of Research in Personality*, *69*, 110–123. https://doi.org/10.1016/j.jrp.2016.06.006

Wolff, F., Sticca, F., Niepel, C., Goetz, T., Van Damme, J., & Möller, J. (2020). The reciprocal 2I/E model: An investigation of mutual relations between achievement and self-concept levels and changes in the math and verbal domain across three countries. *Journal of Educational Psychology*, *113*(8), 1529–1549. https://doi.org/10.1037/edu0000632

Wouters, S., De Fraine, B., Colpin, H., Van Damme, J., & Verschueren, K. (2012). The effect of track changes on the development of academic self-concept in high school: A dynamic test of the big-fish–little-pond effect. *Journal of Educational Psychology*, *104*(3), 793–805. https://doi.org/10.1037/a0027732

Wu, H., Guo, Y., Yang, Y., Zhao, L., & Guo, C. (2021). A meta-analysis of the longitudinal relationship between academic self-concept and academic achievement. *Educational Psychology Review*, *33*(4), 1749–1778. https://doi.org/10.1007/s10648-021-09600-1

Zeigler-Hill, V., Holden, C. J., Enjaian, B., Southard, A. C., Besser, A., Li, H., & Zhang, Q. (2015). Self-esteem instability and personality: The connections between feelings of self-worth and the Big Five dimensions of personality. *Personality and Social Psychology Bulletin*, *41*(2), 183–198. https://doi.org/10.1177/0146167214559719