

# **Personality in Adolescence: School as a Developmental Context**

## **Dissertation**

zur Erlangung des Doktorgrades  
an der Universität Hamburg,  
Fakultät für Psychologie und Bewegungswissenschaft,  
Institut für Psychologie

vorgelegt von  
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Hamburg, 2021

Date of thesis defense:

15. Juni 2021

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*I'm still standing.*

*Elton John*

## **Danksagung**

... und dazu haben viele besondere Menschen während dieser Phase beigetragen.

Zunächst einmal möchte ich meiner Erstbetreuerin Prof. Dr. Jenny Wagner von Herzen danken. Danke dafür, dass du mich durch viele spannende Diskussionen für die Forschung begeistert und mir eine umfangreiche Ausbildung ermöglicht hast. Vielen Dank auch für deine Unterstützung in jeglichen Dissertations- und Lebensphasen, bei der Ermöglichung der ein oder anderen verrückten Idee, für deinen Glauben an mich und dafür, dass du mich hast meinen Weg gehen lassen. Auch meinem Zweitbetreuer, Prof. Dr. Oliver Lüdtke, gilt ein großes Dankeschön. Du hast meine Begeisterung für die Statistik maßgeblich geprägt, wurdest nicht müde, immer wieder neue Lösungen für Herausforderungen zu diskutieren und standest mir stets mit Rat und Tat zur Seite. Des Weiteren möchte ich der gesamten Prüfungskommission für ihren Einsatz zur Vorbereitung und Durchführung der Disputation danken.

Ein weiterer Dank gilt meinen Kolleg\*innen und Freund\*innen sowohl vom IPN als auch vom Fachbereich PPPE in Hamburg. Ohne euch wäre die Arbeitszeit nur halb so schön gewesen! Ganz besonders möchte ich mich bei Naemi, Jenny und Simon bedanken. Danke, dass ihr immer ein offenes Ohr hattet und die inspirierenden Gespräche nicht nur für bessere Ergebnisse, sondern auch für mehr Freude und Motivation gesorgt haben. Naemi, Laura und Bella, euch gilt zudem ein besonderer Dank für euer Engagement beim Lesen dieser Arbeit!

Darüber hinaus möchte ich mich auch bei meiner Familie und meinen Freund\*innen außerhalb der Wissenschaft bedanken. Ihr habt mich mit jeder Menge Begeisterungsfähigkeit, viel Durchhaltevermögen und sowieso mit allem ausgestattet, was ich für ein erfülltes Leben benötige. Danke für euren unerschütterlichen Glauben an meine Fähigkeiten, für die liebevollen Worte zu jeder Tages- und Nachtzeit, für die lustigen Ablenkungsmanöver und dass ihr mich auch in meinen anstrengenden Phasen ertragen habt. Dafür habt ihr alle eine Auszeichnung verdient! Danke Bella, du warst die beste ATB, die man sich wünschen kann. Und Tim, ich danke dir für dein beeindruckendes Ausmaß an Geduld, deine Fürsorglichkeit und deinen Optimismus sowie dafür, dass du mir immer wieder zwischendurch vor Augen geführt hast, was sonst noch wichtig und schön ist.



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## Summary

There is hardly another period in life that poses more puzzles to personality psychology than adolescence, covering the age span between 10 and 19 years. Adolescents' personalities show the lowest stabilities besides childhood as well as unspecific dips and increases in mean-level trends. Moreover, this period in life is characterized by a diverse set of changes and developmental tasks in different areas. Adolescents need to develop a coherent self-view and identity, lay a basis of achievement for later career possibilities, build up positive relationships, and, thus, fulfil new social roles while maintaining their mental and physical well-being. Whereas personality was already identified as a strong resource (or risk factor) for many life outcomes in adulthood, less is known about antecedents and consequences of personality development in adolescence. Thus, the present dissertation aimed at gaining a deeper understanding of the cross-sectional and longitudinal interplay of adolescents' personality and mastering developmental tasks in the context of school. By integrating theories from personality, developmental, and educational psychology I laid the theoretical foundation for deriving my research question. Considering theoretical and empirical findings emphasized the need of including different adolescent age groups during adolescence, a multi-rater approach of personality, and a variety of developmental tasks. In doing so, this thesis focused on the context of school, where adolescents spend the vast majority of their time and where most of these tasks have to be accomplished.

All three studies focus on a general understanding of the interplay between personality and different development tasks in school. To create a solid basis, *study 1* provides a cross-sectional overview about age- and rater-differentiated associations between the Big Five personality traits and a set of school-related psychosocial aspects in three main developmental task domains: achievement, social relationships, and psychosocial adjustment. *Study 2* contributes to a better understanding of the longitudinal interplay between adolescents' personality and four different achievement indicators from seventh to ninth grade. Additionally, family cohesion was included to test its predictive power on personality and achievement change. The research aim of *study 3* is to gain a deeper understanding of antecedents and consequences of personality development by including all three developmental task domains. It investigates the joint development of the Big Five and indicators from achievement, social relationships, and psychosocial adjustment across several measurement points from early to middle adolescence. To address these questions, I analysed three different cross-sectional and longitudinal educational large-scale panel data sets. The three studies include all Big Five

personality factors, focus on key developmental tasks, consider the topic from different rater perspectives, and concentrate on the underrepresented first half of adolescence.

The results underscore personality as a crucial factor for successful school experiences. Adolescents' thinking, feeling, and behaviour (i.e. their personality) relate to their academic achievement, social relationships, and psychosocial adjustment in school, both cross-sectionally and longitudinally. Whereas conscientiousness appears as general resource for all of the three school-related experience domains, extraversion showed age-, rater-, and outcome-specific results. The longitudinal interplay indicates a joint change of personality and school experiences showing the relevance of the educational context of school for development. Psychosocial adjustment is the developmental task domain that explains most personality changes across different traits. The relevance of adjustment and self-regulatory capacities as foundation for further positive developmental trajectories call for interventions that foster adolescents' well-being.

Overall, the current dissertation makes three contributions to the literature. First, it integrates insights from different research fields to theoretically enrich approaches for personality development in adolescence. Second, in concert, studies 1 to 3 provide novel insights into the specific interplay between adolescent personality and developmental tasks. These findings emphasize an adolescent's personality as strongly interwoven with how they master developmental tasks. Third, this thesis highlights the significant role of the school context and draws attention to its potential for supporting positive development in adolescence. Future research needs to further disentangle the co-development of personality and school experiences by including biological processes, closer time intervals and micro-level processes, personality facets and items, and multimethodological approaches. This way, one can do justice to the complexity of simultaneous developmental processes in adolescence.





# *Chapter 1*

Theoretical Background



## Theoretical Background

People have been fascinated by studying the personality of humans for millennia. Already 2,000 years ago Hippocrates wrote about four different personality types and claimed that personality and physical health were interrelated. Despite the strong interest in personality and its correlates, personality research lacked a generalizable and shared conceptualization of personality for a considerable time. It was only with the development of the Big Five personality taxonomy that researchers agreed on a general structure for personality (Goldberg, 1990; McCrae & Costa, 1987). Since then, research has provided robust evidence on the significance of the Big Five for diverse areas, such as health, longevity, relationship quality, career success, and happiness (Ozer & Benet-Martínez, 2006; Roberts et al., 2007; Soto, 2019). For a long time, personality was treated as a genetically determined and stable concept (Costa & McCrae, 1994). By now, the definition of personality as interindividual differences in *relatively* stable patterns of thoughts, feelings, and behaviours (e.g., McCrae & Costa, 2008; Roberts, 2009) pronounces the malleability of personality (Anusic & Schimmack, 2016; Caspi et al., 2005; Wagner et al., 2019). In line with this, more recent studies focused on the antecedents and consequences of personality development in adulthood (e.g., Allemand & Martin, 2017; Bleidorn et al., 2018; Denissen et al., 2011; Müller et al., 2019; Wagner et al., 2015; Woods et al., 2013). More precisely, such studies investigated the interplay between personality development and critical life experiences to provide a better understanding of when, why, and how people change (see also Bleidorn et al., 2019).

One central developmental phase in life, characterized by many biological, social, and emotional changes, is adolescence (Keating, 2004; Kilford et al., 2016; Petersen & Leffert, 1995; Steinberg, 2005). Much less is known about personality (development) as well as its correlates and drivers in adolescence than in adulthood (Soto & Tackett, 2015). The environment that most adolescents – at least in the western world – share and where they spend a significant amount of their lives, is school (Rutter et al., 1979). School is a pivotal developmental context because young people's success in managing developmental tasks at school tends to lie the foundation for their future paths of life (Spengler et al., 2018). In addition, most of the developmental challenges children and adolescents have to face emerge in the broader social context of school (Eccles & Roeser, 2011; Meece & Schaefer, 2010). As a consequence, young people and adolescents could benefit in particular from knowledge about the dynamics between personality development and educational environments. While findings from the beneficial role of personality for developmental tasks in adulthood suggest that personality in adolescence may function as a resource to succeed in the context of school

(Roberts et al., 2007), research has not provided conclusive results on this matter. Former studies that have investigated the associations between adolescents' personality and school experiences have mostly focused on academic achievement and derives their insights from cross-sectional data (e.g. Lechner et al., 2017; O'Connor & Paunonen, 2007; Spengler et al., 2013). Little attention has been paid to the association of personality and other important experiences in school such as, for example, establishing positive relationships or physical and psychological adjustment. Furthermore, even less is known about the factors that drive personality development in adolescence, although personality traits are seen as changeable by and susceptible to environmental factors such as age-related experiences (Roberts et al., 2005; Wagner et al., 2020). Therefore, school-related experiences could be affected by personality on the one hand, and might explain personality development itself on the other hand.

In the present dissertation, I investigate and discuss the role of personality development in adolescence by focusing on the school context. I conducted three studies that help to shed light on the cross-sectional and longitudinal interplay between adolescents' personality and diverse school experiences. Since the joint consideration of different research areas can provide nuanced information, I review and integrate theoretical concepts from personality, developmental, and educational psychology in the first chapter of this synopsis. Afterwards, I provide an overview of the empirical findings with respect to personality development in adolescence and the interplay of personality and school experiences. Finally, I integrate theoretical and empirical findings to derive my research questions.

### **Theoretical Perspectives on Personality (and) Development in Adolescence**

So far, the majority of conceptual and empirical research in personality psychology has put a strong emphasis on adulthood, thus leaving personality development in adolescence without a clear theoretical foundation. So far, we have only a vague idea of why personality in adolescence shows unspecific developmental trajectories and if the suggested mechanisms in adulthood can be mapped onto adolescence (Borghuis et al., 2017; Klimstra et al., 2009; Soto & Tackett, 2015; van den Akker et al., 2014). In contrast, developmental psychology offers the concept of specific developmental tasks in adolescence that needs to be mastered for a positive development (Erikson, 1968; Havighurst, 1972). Ideas from educational psychology provide a context, that is particularly relevant for an adolescents' development, namely school. Bridging the gap to the role of personality, recently, adolescents' personality as resource for these different requirements moved into focus (De Fruyt et al., 2017; Hill & Edmonds, 2017; Soto & Tackett, 2015). Therefore, to understand antecedents and consequences of adolescents'



personality development at school, I introduce and rely on different theories from personality, developmental, as well as educational psychology to theoretically underpin my research question.

### **Personality Perspectives**

From a personality perspective, adolescence is regarded as a transitional phase between two important stages of life, where “storm and stress” dominate the courses of personality development (Arnett, 1999; Freud, 1958; Hall, 1904). Thus, less systematic personality development during adolescence complicated theoretical assumptions about developmental trajectories of adolescents’ personality. In addition, the concept of personality and its measurability had been questioned for decades, consequently producing scientific pluralism and inhibiting new scientific insights about personality and its potential development (John et al., 2008; McAdams, 2019; see also Mischel, 1968). The scientific debate led to an agreement with respect to the conceptualization of personality and, hence, to an intensification of research on personality development during the last two decades. Theoretical and empirical effort brought robust findings about general developmental trends and first insights regarding underlying processes, antecedents, and consequences of personality in adulthood (for an overview, see McAdams et al., 2019; Specht, 2017). As the theoretical foundation for personality development in adolescence is scarce, the following review of theoretical frameworks on personality will mostly focus on research in adulthood. First, I give a short overview about the Big Five personality traits. Second, I present one comprehensive theoretical framework describing personality development in (emerging) adulthood: the *Neo-Socioanalytic Model of Personality Psychology* (Roberts & Nickel, 2017; Roberts & Wood, 2006). Third, I summarize and integrate the potential role of self-regulation for personality development in adolescence (Denissen et al., 2013).

#### ***The Big Five***

The Big Five personality traits are nowadays the most accepted and best-researched model of human personality. In 1936, Allport and Odbert used the lexical approach of Galton (1884) to identify around 18,000 words from an English dictionary which could be used to describe a person’s characteristics. Decades later, semantic and empirical data reduction and clustering led to the five-factor model (FFM; McCrae & Costa, 1987; 2008). The core of the FFM are the “Big Five” personality dimensions (Costa & McCrae, 2003; Goldberg, 1990) that can be divided in different facets, each of which represents a narrower personality analysis unit (McCrae & Costa, 1987; McCrae & John, 1992). Even though other theoretical frameworks,

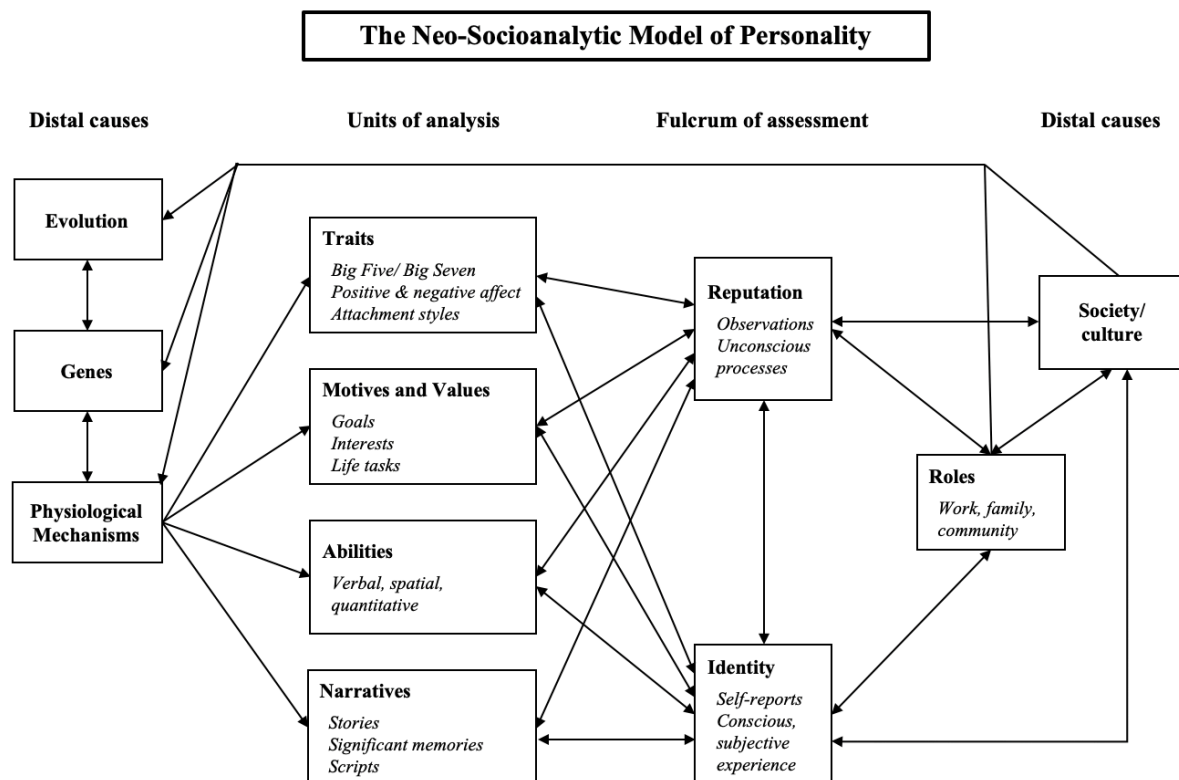
proposing a different number of higher order personality factors have been advanced over time, (Ashton & Lee, 2007; DeYoung, 2015; Saucier, 2003; van der Linden et al., 2010), the Big Five continue to dominate the research field. In this dissertation, I therefore concentrate on the taxonomy of the Big Five and, thus, focus on theoretical perspectives and empirical evidence regarding the five factor structure. The Big Five include emotional stability, extraversion, openness, agreeableness, and conscientiousness (Costa & McCrae, 2003; John et al., 2008). Emotional stability describes thoughts, feelings, and behaviours of security, even-temperedness, and low stress reactivity. Extraversion covers the tendency to be active, outgoing, sociable, and assertive. Openness to experience manifests in intellectual engagement, creativity, open-mindedness, and originality. Agreeableness is the tendency to be compassionate, trustful, modest, and altruistic, whereas conscientiousness covers characteristics such as self-discipline, responsibility, organization, and impulse control. These traits can be found across different age groups (Brandt, Becker et al., 2020; Soto et al., 2011) and thus, the Big Five provide a reliable framework to investigate personality in adolescence.

### ***The Neo-Socioanalytic Model***

The Neo-Socioanalytic Model proposes the dynamic interaction between personality and environmental contexts with additional principles explaining stability and change of personality during adulthood (Specht et al., 2014; Tucker-Drob & Briley, 2019; Wagner et al., 2020). The Neo-Socioanalytic Model draws on former theoretical ideas, that is the FFM (McCrae & Costa, 1999), the Levels Theory (McAdams & Pals, 2006) and most of all the Socioanalytic Theory of Personality (Hogan & Blicke, 2013). It comprises two overarching parts: firstly, as can be seen in Figure 1.1, a framework that captures personality and different aspects contributing to its development and secondly, eight principles about continuity and change of personality across the adult life span (Roberts & Nickel, 2017).

According to the framework different units of analysis exist, including personality traits as well as personality characteristics in a broader sense, like motives and values, abilities, and narratives. These personality units can be viewed through different lenses – by that of the self and by that of other observers, representing the two entities of *identity* (self-reports) and *reputation* (other reports). Furthermore, the framework lays a focus on the interaction between personality and the so-called distal factors. Hereby, a distinction is made between biological factors, i.e. evolution, genes, and physiological mechanisms, as well as environmental contexts that contain different social roles. These roles serve two main human basic motives, namely the need for status and the need for belongingness (Hogan & Blicke, 2013). In eight principles, the

Neo-Socioanalytic Model proposes how these social roles and the interaction of people with their environment can explain stability and change of personality.



**Figure 1.1** The Neo-Socioanalytic Model of Personality Psychology (adapted from Roberts & Nickel, 2017, p. 158)

I shortly introduce the four principles that have been empirically tested the most and for which ample evidence was found for (Roberts & Nickel, 2017). The *plasticity principle* posits that a person's personality can change at any age across the life span (e.g. Lucas & Donnellan, 2011; Roberts & DelVecchio, 2000). Thereby, the rank-order stability increases till the age between 50 and 60 and shows a plateau or a decreasing trend afterwards (Roberts & DelVecchio, 2000). This is referred to as *cumulative continuity principle*. The *maturity principle* refers to the systematic change in the direction of a more mature personality, i.e. becoming more emotional stable, agreeable, and conscientious (Roberts & Wood, 2006), which can mainly be found in the transition from adolescence to young adulthood (e.g. Josefsson et al., 2013; Lüdtke et al., 2011; Roberts et al., 2006; Vecchione et al., 2012). The *social investment principle* explains why people develop a more mature personality: As becoming older, they have to adapt to and invest in new social roles, such as working positions or those

within a relationship or family (e.g. Bleidorn, 2012; Lodi-Smith & Roberts, 2007; Wagner et al., 2015). These roles provide new lasting experiences and impose new expectations from the respective context but also from society in general. The adaptation to the requested demands to fulfil the role successfully then leads to personality development. As this theory with its principles can only partly be mapped onto adolescence, I introduce the self-regulation perspective that explicitly focuses on adolescence (Denissen et al., 2013).

### ***The Self-Regulation Perspective***

The self-regulation approach (Denissen et al., 2013) also underlines the malleability of personality across the life span as well as the importance of social roles and the associated changes or manifestations in the demands on people. Based on the emotion regulation model of Gross and Thompson (2007), self-regulation refers to *reference values* as part of either environmental aspects (i.e. antecedents focused, e.g. selection of a certain situation) or the own behaviour (i.e. reaction focused, e.g. suppression of anger). This perspective extends the social investment principle (Roberts & Nickel, 2017) by proposing that self-regulation, i.e. the ability to reduce the discrepancy between the current condition and a specified target state of a person (Carver & Scheier, 2001), is the mechanism behind personality development through the investment in new social roles (Denissen et al., 2013). New roles often require another behavioural repertoire. To meet the expectations associated with a new role, a person will likely set new desired behavioural standards or reference values, such as being self-confident when getting promoted. The constant use of new behavioural patterns manifests themselves over time in a person's personality. Stability of personality on the contrary is explained through stable reference values. With respect to adolescence, Denissen and colleagues (2013) provide two possible explanations for the diffuse change patterns found in adolescent personality trajectories. First, regulatory capabilities are not yet fully developed with respect to the neuronal foundation (Steinberg, 2007). Second, adolescents rather choose immature than mature desired reference values as one part of their "storm and stress" period (see also the theory of antisocial behaviour; Moffitt, 1993). To summarize, the self-regulation perspective posits a shift in desired references over the life course and the necessary self-regulatory abilities as driving mechanisms for personality development.

Taken together, theoretical assumptions about personality development in adolescence are scarce, although some parts and principles of the Neo-Socioanalytic Model (Roberts & Nickel, 2017) might be transferrable to adolescence. The self-regulation approach (Denissen et al., 2013), however, illustrates that differentiating mechanisms such as regulatory capacities should be regarded in adolescence. To identify valuable entry points, considering the

developmental psychology perspective on adolescence can provide a better understanding of this period's uniqueness.

### **Developmental Perspectives**

Development can be understood as a dynamic, continuous, and reciprocal interaction between individuals and their environment over the life course (Magnusson, 1990). The original debate about the crucial influencing factors for a person's development contrasted internal vs. external factors and is known as the nature-nurture controversy (Bronfenbrenner & Ceci, 1994; Ceci & Williams, 1999; Lerner, 2002). This debate has turned towards a transactional perspective, which most developmental theories nowadays share (e.g. Baltes, 1987; Bronfenbrenner, 1979; Hennecke et al., 2014; Magnusson & Stattin, 2006; Roberts & Nickel, 2017). One prominent overarching framework is the *Life Span Theory in Developmental Psychology* (Baltes et al., 2006). It lays a focus on the interaction of biological and environmental characteristics of a person – the *basic determinants* – and different events or *influences* that shape this interaction. Baltes and colleagues (2006) propose three different contextual types of *influences* on the interaction of biology and environment: *normative age-graded*, *normative history-graded*, and *non-normative* life events. Each developmental period such as adolescence, however, is expected to have its own developmental agenda which is characterized by distinctive normative age-graded developmental tasks (Erikson, 1959; Havighurst, 1972). In the following, I explain the specificity of adolescence as a developmental phase and introduce the concept of developmental tasks in adolescence.

### ***The Developmental Phase of Adolescence***

Adolescence is characterized by tremendous biological, cognitive, and social changes as well as by the overall need for the development of social-emotional skills to adjust to these changes (Petersen & Leffert, 1995; Weissberg et al., 2015). Biological development can roughly be subsumed under puberty as a profound biological transition that contains a development of the brain-neuroendocrine processes, a change in the hormonal composition, and severe physical changes including the capacity to reproduction (Blakemore et al., 2010; Susman & Rogol, 2004). Cognitive changes involve an increase in abstract reasoning, more efficient information processing and more conscious, self-directed thinking and behaviour (Keating, 2004; Steinberg, 2005). Socially, adolescents administer a transition from the family as their main social context to a peer context as well as transformations within these relationship clusters (Collins & Steinberg, 2006). These changes are also reflected in the need for emotional adjustment that can be associated with more social competence, empathy and less behavioural

problems (Eisenberg & Fabes, 2006). In addition, adolescents are confronted with fast societal change due to an increase in online activities that come along with changing social interaction conditions and different needed skills (Twenge et al., 2018; Twenge et al., 2019; Voogt et al., 2013). However, nowadays the description of “storm and stress” rather refers to the amount of changes and the complexity of societal demands as adolescents’ development is not necessarily problematic and turbulent (Hollenstein & Loughheed, 2013; Rutter, 1995). Nevertheless, it is a period with tremendous changes, which becomes particularly clear when comparing a 10-year-old with a 19-year-old. Therefore, the phase of adolescence is sometimes divided in early (10 to 13 years), middle (14 to 16 years), and late adolescence (17 to 19 years) in order to meet the strong and diverse developmental changes (Petersen & Leffert, 1995). Especially early and middle adolescence are surprisingly underrepresented age groups in different research areas (Lohaus, 2018; Petersen & Leffert, 1995; Soto & Tackett, 2015). The extent of change makes it both challenging and fascinating to investigate the period of adolescence.

### ***Developmental Tasks***

With respect to the field of developmental psychology, a widespread view is that people have to master different tasks for a successful development whose content is dependent on the current stage in life, such as adolescence. The by now well-established concept of development tasks was originally proposed by Havighurst (1948) and has been taken up by different researchers since then (e.g. Coleman, 1974; Erikson, 1959; Havighurst, 1972, Hurrelmann & Quenzel, 2018; Hutteman et al., 2014). The concept was initially developed for the educational and pedagogical field. It was meant to help teachers better to understand the developmental stages and, consequently, the different challenges of their students in order to improve their teaching strategies (Eschenbeck & Knauf, 2018; Havighurst, 1948). According to Havighurst (p. 2, 1948), “[a] developmental task is a task which arises at or about a certain period of life of the individual, successful achievement of which leads to his happiness and to success with later tasks, while failure leads to unhappiness in the individual, disapproval by the society, and difficulty with later tasks.” In accordance to the Life Span Theory (Baltes et al., 2006), developmental tasks result from biological changes, age-related societal expectations and individual norms and values which interact with each other (Havighurst, 1948). Moreover, they can be embedded in the Life Span Theory as normative age-graded influences on adolescents’ development (Baltes et al., 2006). Typical developmental tasks for adolescents were described as learning a profession, taking social responsibility, building and acting after a value system, establishing romantic and peer relationships, breaking away from their parental home (emotionally and financially), the acceptance of the own body, and the confrontation with the

female or male gender roles (Havighurst, 1972). As society, biology, and the typical adolescent life have changed during the last decades (Arnett, 2000; Gehlbach, 2014; Seiffge-Krenke & Gelhaar, 2008), researchers from the 21st century propose partly different tasks (Eschenbeck & Knauf, 2018). Grob and Jaschinski (2003) differentiate between three task groups: intrapersonal tasks (e.g. defining own values), interpersonal tasks (e.g. building up and maintain new friendships), and sociocultural tasks (e.g. choose a career path). Hurrelmann & Quenzel (2015, 2018) on the contrary suggest four task areas: the acquisition of school and professional qualifications, the development of gender identity and the establishment of social relationships, the responsible consumption of media and leisure activities and finally, and the development of a value system. Some of the aforementioned tasks can also be understood as part of identity exploration (Crocetti et al., 2008; Klimstra et al., 2010; Klimstra & van Doeselaar, 2017), which is one main task in adolescence as originally posited by Erikson (1950, 1968). Identity, in contrary to role confusion, can be understood as the experience of inner wholeness, the integration of own and others expectations, and the ability of integrating new experiences in a coherent view on the self (Erikson, 1968). Meeting these tasks is seen as necessary for a positive development in the next stage of life.

Altogether, development is understood as interplay between individuals and their environment (e.g. Baltes et al., 2006; Magnusson, 1990). The specific phase of adolescence is characterized by both severe biological changes (Petersen & Leffert, 1995; Susman & Rogol, 2004) and a variety of age-graded developmental tasks (Havighurst, 1972). Although different researchers propose different tasks, most agree on three main clusters of developmental tasks that need to be solved in adolescence: educational qualification, establishing good relationships, as well as building and adjusting to a set of own and sociocultural values. One context that confronts adolescents with these tasks is school.

### **Educational Perspectives**

Schools can be seen as one normative age-graded environment for adolescents where they spend on average more than a decade and, therefore, almost the whole life phase of adolescence (Eccles & Roeser, 2011; Rutter et al., 1979). School experiences range from gaining knowledge to social interactions with peers and teachers, forming relationships, and the extensive examination with the own mental and physical well-being. These experiences have been investigated through different research lenses such as development, sociology, pedagogy, and policy (Meece & Schaefer, 2010; Wang & Eccles, 2012; Weissberg et al., 2015). Thus, successful schooling expresses itself in a broad educational mission that, in addition to

imparting knowledge, also aims at raising responsible members of society (Kunter, 2005). Referring to this mission, the *Stage-Environment Fit Theory* (Eccles & Midgley, 1989; Eccles et al., 1993; Eccles & Roeser, 1999) offers a framework that clarifies school influences on a student's development.

### ***Stage-Environment Fit Theory***

The Stage-Environment Fit Theory highlights the interaction between individual characteristics and the school environment for explaining a student's thinking, feeling, and behaviour (Eccles & Midgley, 1989). Eccles & Roeser (1999) accentuate that schools are complex systems and as such have to be regarded at different levels. This hierarchical ordering includes four levels spanning the micro- to macro-perspective: the individual in the classroom (1), the school as organization (2), the school district (3), and the community including different districts within a cultural system (4). Each level is "composed of various regulatory processes (organizational, interpersonal, and instructional in nature)" which are dynamic and interact across levels (Eccles & Roeser, 2010, p. 6). According to this theory, dynamics change when students are confronted with school transitions, i.e. they differ in elementary vs. high school. All these processes can shape a student's behavioural, cognitive, and social-emotional development (Eccles & Roeser, 2010). Furthermore, this theory proposes a necessary fit between the students' needs and the characteristics of the school for a positive development of the student (Wang & Eccles, 2012). In accordance to the basic needs of self-determination theory (Deci & Ryan, 2004), students' needs for competence, relatedness, and autonomy change as they mature (Chung et al., 1998; Osterman, 2000; Ratelle & Duchesne, 2014; Wehmeyer & Shogren, 2017). What school environments can offer, however, must not be congruent with these needs (Wigfield et al., 2006). This mismatch would lead to less school engagement and satisfaction, especially in the secondary school years (Wang & Eccles, 2012). Thus, academic achievement, social relationships, and adjustment within the system can be seen as key aspects of school for a student's development.

Taken together, school offers a wide range of experiences and is likely to shape adolescents' development in different ways (Eccles & Roeser, 2010; Meece & Eccles, 2010; Mortimore, 1995). The Stage-Environment Fit Theory proposes a dynamic interplay between students' characteristics and the school system. Accordingly, the focus lies on the influences of school characteristics for a desired positive development of the students as this is a central task of education.



## **Integrating the Ideas of Different Fields**

The theoretical frameworks of personality, developmental, and educational psychology suggest slightly different but also overlapping mechanisms for how a person's (personality) development takes place. By integrating the ideas of different frameworks, I lay the theoretical foundation for answering three questions. First, which developmental mechanisms (from adulthood and different fields) can also be applied to adolescents' personality development? Second, which developmental tasks can be identified as crucial in adolescence? Third, why is school a noteworthy context to investigate the (longitudinal) interplay between personality and developmental tasks in adolescence?

### ***Development Principles and Their Applicability to Adolescence***

First of all, the three theoretical views meet on the common ground, that development is rooted in the interaction of a person and the environment (Baltes et al., 2006; Eccles & Roeser, 2011; Lewin, 1951; Murray, 1938; Roberts & Nickel, 2017). Thus, a person with her or his biologically manifested characteristics will choose, interact with, and change the environment. The environment in turn, which also comprises social and emotional experiences (Meece & Eccles, 2010), should also influence a person's thinking, feeling, and behaviour, and thus, her or his personality development. The Neo-Socioanalytic Model (Roberts & Nickel, 2017) distinguishes between biological and environmental distal causes, the latter are operationalized as social roles and expectations. Both influence and get influenced by personality traits as one unit of analysis and also interact with each other. The Life Span Theory (Baltes et al., 2006) integrates the person-environment interaction as basic determinants of biology and environment. The Stage-Environment Fit Theory (Eccles & Roeser, 2010) puts the interaction between students and the school environment on different levels in the focus. Overall, according to this basic assumption of all three fields, a person's behaviour and development is jointly determined by both personal and environmental characteristics. Thus, personality as a core aspect of a person should longitudinally interact with aspects from the environment – also during adolescence.

Diving deeper into the proposed principles of the Neo-Socioanalytic Model, at least two of the introduced development principles can also be applied to adolescence. Personality shows stability and change during adolescence, i.e. the plasticity principle, and rank-order stability was found to increase from childhood over adolescence to adulthood, i.e. cumulative continuity principle (e.g. Briley & Tucker-Drob, 2014; Roberts & DelVecchio, 2000; Roberts et al., 2006). The maturity principle, however, does not fully describe the general mean-level trend in

adolescence, which is instead characterized by dips in all traits and also referred to as *disruption hypothesis* (Borghuis et al., 2017; Göllner, Roberts et al., 2017; Luan et al., 2017; van den Akker et al., 2014). Accordingly, the social investment principle cannot explain a developmental pattern of maturity, as there is not such a clear trend in adolescence. Nevertheless, the investment in new social roles might also explain the dips when considering the principles of the other theories. The self-regulation approach suggests that adolescents do not have the regulatory abilities yet to meet these new social roles, associated tasks, and societal expectations (Denissen et al., 2013). The discrepancy between abilities and societal expectations would then lead to opposite personality trait trajectories of maturation (Denissen et al., 2013). This argument can also be linked to the Stage-Environment Fit Theory (Eccles & Roeser, 2010), which explains the negative developmental trends in adolescence through a disparity between the students' needs and what the school system provides. Moreover, Havighurst (1972) as well as Erikson (1959) describe developmental tasks for adolescents, such as building and acting after a value system, which lay the foundation for following maturation processes in personality (Hill & Edmonds, 2017).

Summarizing the ideas from personality, developmental, and educational psychology, it can be noted that adolescents are confronted with new social roles, expectations, and associated developmental tasks. These new requirements involve skills that have yet to be developed. Depending on resources and self-regulatory abilities, normative age-graded experiences should have different effects on adolescents' development (Baltes et al., 2006; Denissen & Penke, 2008).

### ***Selecting Developmental Tasks***

When investigating the interplay between personality and school experiences in adolescence, a selection of important experiences is needed. All presented theories define environmental aspects that should interact with personality, which are social roles (Roberts & Nickel, 2017), developmental tasks (Havighurst, 1972), and the fit in psychological needs and school offerings (Eccles & Roeser, 2010). The relevant motives and needs that underlie development show a large overlap. In the Neo-Socioanalytic Model, the environment is operationalized as social roles and associated societal expectations, which fall into two broad categories that serve status and belongingness motives (Hogan & Blicke, 2013). The defined developmental tasks for adolescents meet these motives (Grob & Jaschinski, 2003; Havighurst, 1972; Hurrelmann & Quenzel, 2015): Educational qualification can be linked to status, and establishing social relationship relates to belongingness. In adolescence, a third task domain can be highlighted, which is the exploration of identity, including the formation of a value set

and the adjustment to the occurring biological, social, emotional, and sociocultural changes (Erikson, 1968; Grob & Jaschinski, 2003; Hurrelmann & Quenzel, 2015; Weissberg et al., 2015). Moreover, this intrapersonal development can be associated with the development of self-regulation abilities (Baumeister & Vohs, 2007) that in turn seem to play a special role for personality development in adolescence (Denissen et al., 2013). Although especially this last domain is very complex and can hardly contain every associated aspect, I summarize the domain as developmental tasks of psychosocial adjustment. With respect to the school context, these tasks map mostly onto the basic psychological needs, i.e. competency, relatedness, and autonomy (Deci & Ryan, 2004), that are referred to in the Stage-Environment Fit Theory (Eccles & Roeser, 2010). These basic needs are part of everyday life in school and have been associated with academic achievement, social relationships, and adjustment indicators (Gnambs & Hanfstingl, 2016; Ratelle & Duchesne, 2014; Tian et al., 2016). Thus, based on theoretical and empirical notions above, I suggest three key developmental task domains of the school environment that might help better to understand the longitudinal interplay with personality in adolescence: academic achievement, social relationships, and psychosocial adjustment.

### ***School as a Crucial Developmental Context***

Drawing on theoretical assumptions from all three research fields, on the basis of their personality humans influence their environment and, the environment offers decisive experiences, which potentially loop back on personality (Baltes et al., 2006; Eccles & Roeser, 2011; Roberts & Nickel, 2017). The context of school deserves a closer look as such an environment for several reasons. Besides the family context, adolescents spend the vast majority of their time and of their youth in school (Eccles & Roeser, 2011; Rutter et al., 1979). It is the primary task of school to educate students. Beside the transfer of declarative and procedural knowledge and competences (Hartig & Klieme, 2006; Köller & Baumert, 2002), education includes the goal of personality development promotion (Kunter, 2005). Hence, school offers resources (Hattie, 2009; Mortimore, 1995; Prince-Embury et al., 2016) that are necessary for self-regulatory and adjustment processes (Baumeister & Vohs, 2007). Moreover, what students learn in school and their educational attainment are predictive for later career success (Spengler et al., 2018). Overall, school functions as a normative age-graded context, where adolescents inevitably gain experiences by learning, interacting with others, and therefore socially and emotionally develop (Meece & Eccles, 2010). Thus, several developmental tasks of adolescence take place in school: the preparation for a career path, the establishment and the maintenance of social relationships, as well as psychosocial adjustment

with regard to these challenges including the development of self-regulatory abilities (Grob & Jaschinski, 2003; Hartup & Stevens, 1999; Havighurst, 1972; Hurrelmann & Quenzel, 2015; Simmons & Blyth, 1987). Hence, in school adolescents are confronted with various experiences and enduring changes in social roles which mark one key factor for personality development (Baltes et al., 2006; McAdams et al., 2019; Roberts & Nickel, 2017).

Combining the different perspectives to investigate the longitudinal interplay of personality in adolescence, I base my research questions on three findings. First, in adolescence, the mastering of developmental tasks as well as self-regulation and adjustment can be regarded as interacting mechanisms with an adolescent's personality development. Second, significant school experiences should be related to the domains of academic achievement, social behaviour and relationships, and psychosocial adjustment. Third, the context of school is a worthwhile setting to investigate the interaction of personality and relevant experiences in adolescence. I summarize empirical findings about personality development in adolescence and its interplay with the derived school experiences in the following section.

### **Empirical Evidence on Personality Development and School Experiences**

Although personality increasingly moved into the focus of society (Bleidorn et al., 2019; Roberts et al., 2017), less attention has been paid to the role of personality and its development in adolescence. Reasons might lay in remaining open questions concerning personality measurement, differences in self- and other ratings of personality, and the (un)similarity regarding the developmental trends of personality traits in comparison to later life periods (Caspi et al., 2005; Soto & John, 2014; Soto & Tackett, 2015). During adolescence, personality is characterized by an indistinctive pattern of dips and increases whose sources and trajectories are still not known. School, as one pivotal developmental context for adolescents' personality (Aviles et al., 2006; Eccles & Roeser, 2011; Kunter, 2005), offers multiple experiences that could function as antecedents and consequences of personality development in this age group and, consequently, providing a promising path for investigating these research gaps.

### **Personality Development in Adolescence**

Whereas a consensus has emerged with respect to the number and structure of personality traits as well as their hierarchical foundation and developmental patterns in adulthood (John et al., 2008), these insights cannot exactly be transferred to the phase of adolescence (Soto & Tackett, 2015). Understanding similarities and differences is necessary for comparing findings between adolescence and adulthood. In this section, I refer to

personality measurement in adolescence, developmental trajectories of the Big Five during this developmental phase, and the inclusion of different perspectives on personality.

### ***Personality Structure and Measurement***

The personality research tradition in childhood described interindividual differences in motoric, emotional, and attentional reactivity and behaviour as temperament (Rothbart, 2007). The Big Five on the contrary were originally seen as a mature psychological concept for personality in adulthood (Caspi et al., 2005) leaving adolescence as a time of transition between traditional concepts (Rothbart, 2007). A growing research body, however, has investigated personality concepts, structure, and measurement in adolescence, and eventually, yielded different conclusions about foundation, similarities and differences between personality in adolescence and adulthood (e.g., Brandt, Becker et al., 2020; Shiner & DeYoung, 2013; Soto et al., 2008; Soto & Tackett, 2015; Tackett et al., 2012).

First, as common ground in all phases of life, personality has a stable and a malleable part (Roberts & DelVecchio, 2000) and is shaped by heritability and the environment (Krueger & Johnson, 2008). Furthermore, temperament can be related to the Big Five personality traits proving the textual linkage between both personality research concepts (Evans & Rothbart, 2007; Shiner & DeYoung, 2013).

Second, regarding the Big Five structure, personality in adolescence is comparable to adulthood with respect to some points. Research supports the hierarchical organization of the traits in adolescence (Caspi & Shiner, 2006; Soto & John, 2014). Moreover, the Big Five can also be applied in adolescence when the range of a young person's behaviour has grown in complexity (Allik et al., 2004; Marsh et al., 2013; Soto et al., 2008; Tackett et al., 2012). Measurement invariance from age 10 to late adulthood was reported even in short Big Five inventories (Brandt, Becker et al., 2020).

Third, besides similarities, research illustrated differences between adolescents' and adults' personality measurement. Personality theory assumes that the five personality factors are nearly uncorrelated (Costa & McCrae, 1995), while empirical research often found significant correlations between the Big Five (Ashton et al., 2009; Brandt, Becker et al., 2020). However, especially stronger interrelations between agreeableness and conscientiousness among adolescents compared to adults suggest a contextual overlap in younger age groups and a later differentiation of conscientious and agreeable behaviours (Soto, 2016; Soto et al., 2008; Tackett et al., 2008). Also, the textual differentiation of openness seems to change from early adolescence to adulthood relating to the neural, cognitive, and emotional development in that phase (Caspi et al., 2005; Soto & John, 2014). Although the five factor structure can be reliably

shown in adolescence, one way of handling the differences in the measurement of the Big Five is the additional modelling of an acquiescence factor (Soto et al., 2008). This factor accounts for the tendency to agree on items which is more pronounced in early than in late adolescence and adulthood (Soto et al., 2008). Among other things these challenges of measuring personality in childhood and adolescence led to an increased use of other reports of personality, mostly parent reports (e.g. De Pauw et al., 2009; Kohnstamm et al., 1998; Soto, 2016; Soto & John, 2014). With increasing age, these other reports are either supplemented or replaced by adolescent self-reports.

Overall, although there are some differences between adolescent and adult personality structure and measurement, the Big Five can encompass personality in adolescence measured by self- and other reports (Brandt, Becker et al., 2020; Göllner, Roberts et al., 2017; Luan et al., 2017; Shiner & DeYoung, 2013; Soto & John, 2014). To understand better developmental trajectories of adolescents' personality and to be able to compare them with adulthood, it is necessary to agree on a common framework whereby the Big Five represent a sound model (Shiner & DeYoung, 2013).

### ***Developmental Trends of Personality***

Developmental trends of the Big Five personality traits are mostly presented with respect to rank-order stability and mean-level changes. In this dissertation, the term personality development subsumes both. Rank-order stability describe the maintenance of a relative ordering on an investigated trait within a population over time. In the current work, I also refer to changes in the rank-order as relative change. Mean-level changes, on the contrary, describe an absolute level change of a trait over longitudinal assessments. Compared to adulthood, relatively few longitudinal studies exist on the Big Five development during adolescence. Table S1 provides an overview about empirical longitudinal studies that include at least two measurement points during adolescence and measured explicitly at least one of the Big Five personality traits. If the same data set was used, I only report additional studies that include new covariates. Otherwise, the most compelling study is presented. As longitudinal data sets are scarce, several cross-sectional studies also investigated age differences during adolescence which are, however, not included in the table (e.g., Allik et al., 2004; Jackson et al., 2009; Slobodskaya & Akhmetova, 2010; Soto et al., 2011).

**Rank-Order Stability.** Proposed in the Neo-Socioanalytic Model, the cumulative continuity principle describes an increase of the rank-order stability from emerging adulthood to old age (Roberts & Nickel, 2017). As already mentioned before, this stabilization can also be observed in adolescence, even though the rank-order stability is lower compared to

adulthood (e.g. Borghuis et al., 2017; Briley & Tucker-Drob, 2014; Klimstra et al., 2009; Roberts & DelVecchio, 2000). In fact, adolescence is the one phase in life with the lowest personality rank-order stabilities besides childhood (Roberts & DelVecchio, 2000), meeting the description of adolescence as a period with many developmental tasks and changes. Dependent on the investigated time span, the (age of the) rater, the inventory, and the personality trait, rank-order stabilities vary between .25 (e.g., Hair & Graziano, 2003; Klimstra et al., 2009; Tackman et al., 2017) and .85 (e.g., Borghuis et al., 2017; Greischel et al., 2016; Klimstra et al., 2009). Most studies report stabilities of self-rated personality traits in adolescence that range between .40 and .70 (e.g., Göllner, Roberts et al., 2017; Pullmann et al., 2006; Vecchione et al., 2012). Those are slightly higher for shorter time intervals, in late compared to early adolescence, for parent ratings of their adolescent children, and when comprehensive personality inventories are used (Göllner, Roberts et al., 2017; Klimstra et al., 2009). Rank-order stabilities for openness and agreeableness are often observed as being lower than those for conscientiousness (Borghuis et al., 2017; Pullmann et al., 2006).

**Mean-Level Change.** Differences between adolescence and adulthood were also found with respect to mean-level trait changes. One of the first personality mean-level change meta-analyses across the life-span was conducted by Roberts and colleagues (2006). For the phase of adolescence, the study aggregated five samples within the age span of 10 to 18 years and showed only small increases for emotional stability and social dominance as a facet of extraversion. No change, however, was found for the other traits. Roberts et al. (2006) concluded that most trait changes were observed in the period of young adulthood (ages between 20 and 40) and that these changes occur in the direction of a more mature personality. Increases in emotional stability, agreeableness, and conscientiousness during young adulthood, known as maturity principle (Roberts & Nickel, 2017), were also reported in other studies (e.g., Bleidorn, 2012; Lucas & Donnellan, 2011; Lüdtke et al., 2011; Neyer & Lehnart, 2007). To investigate if maturation processes already take place during adolescence, following studies on personality development in adolescence aimed at including several time points in order to map the whole phase of adolescence. Findings, however, showed less clear trends than in young adulthood. Some studies revealed increases in emotional stability, agreeableness, and conscientiousness in early (Brandes et al., 2020) and late adolescence (Klimstra et al., 2009; Luan et al., 2017; Vecchione et al., 2012). These findings supported the assumption that maturity describes personality development processes during adolescence. Other studies, however, found no or only slight mean-level changes (De Fruyt et al., 2006; Hair & Graziano, 2003; Hill et al., 2013). Recent studies rather supported an inverse quadratic developmental

trend with dips in socially relevant traits in middle adolescence, called the disruption hypothesis (Borghuis et al., 2017; Denissen et al., 2013; van den Akker et al., 2014). Moreover, several cross-sectional and longitudinal studies reported a decrease followed by an increase mainly in the traits openness, agreeableness, and conscientiousness (Allik et al., 2004; Denissen et al., 2013; Soto et al., 2011; van den Akker et al., 2014). Another study, however, that reached into young adulthood also showed quadratic time trends for emotional stability and extraversion (Borghuis et al., 2017), whereas the investigation of early adolescence (10 to 14-year-olds) led to linear instead of curvilinear time trends (Göllner, Roberts et al., 2017). These findings point to a dip in middle adolescence and to the start of maturation processes in late adolescence.

To summarize, the relatively low rank-order stabilities as well as the dips and increases in mean-levels of the Big Five emphasize the existence of developmentally unique patterns in adolescents' personality. Unfortunately, only few longitudinal personality studies exist that also include the first half of adolescence. One way of gaining additional knowledge about the uniqueness of developmental trajectories in adolescence is the inclusion and comparison of self- and other reports on adolescents' personality.

### ***Different Rater Perspectives***

A common approach in the investigation of personality is the use of different rater perspectives as they provide unique insights (Connelly & Ones, 2010). Different perspectives are also anchored in the Neo-Socioanalytic Model (Roberts & Nickel, 2017) as identity, i.e. the ratings of the self, and reputation, i.e. ratings of others. With respect to personality ratings focusing on adolescents, in most cases the other perspectives are parent ratings (e.g. Brandes et al., 2020; Göllner, Roberts et al., 2017; Luan et al., 2017; Rohrer et al., 2018; Slobodskaya & Akhmetova, 2010; Soto & John, 2014; van den Akker et al., 2014; see also Table S1) and sometimes additional ratings from siblings (Branje et al., 2007; Luan et al., 2017) or teachers (Brandt, Becker et al., 2021; Prinzie & Deković, 2008; van den Akker et al., 2010). Even though peers become more important during adolescence (Arnett, 1999), parents are supposed to know their children well and can provide valid personality measures (Funder, 2012; Luan et al., 2018; Tackett, 2011; Watson et al., 2000). Research has illustrated both significant agreement and differences when comparing adolescent self- and parent perspectives of personality (Göllner, Roberts et al., 2017; Luan et al., 2017; Rohrer et al., 2018; Vazire & Mehl, 2008), which can be summarized in at least three findings. First, research found substantial correlations between adolescent self- and parent ratings of personality (Göllner, Roberts, et al., 2017; Luan et al., 2018), which seem to increase from adolescence to young adulthood (Rohrer et al., 2018). Second, rank-order stabilities and internal consistencies tend to be higher in parent-ratings than



in adolescent self-ratings (Göllner, Roberts et al., 2017; Soto & Tackett, 2015; van den Akker et al., 2014). Third, examining mean-level changes resulted in differences in almost all trait trajectories (Branje et al., 2007; Göllner, Roberts et al., 2017; van den Akker et al., 2014).

There are different explanatory approaches for the reported differences. They can be rooted in the target person, the other rater, in the target trait or the relationship between both raters. One reason could also be a different response tendency of adolescents, as they tend to agree to items, thus, to show a greater acquiescence responding (Soto et al., 2008). Other ratings, however, represent only a valid information source if they possess the necessary information. The *self-other knowledge asymmetry* (SOKA; Vazire, 2010) model explains (dis)agreement with differences in the degree of each trait's *observability* and *evaluativeness*. Thus, it is supposed to be more difficult for another person to rate low observable characteristics such as anxiety (facet of emotional stability) in contrast to talkativeness (facet of extraversion) which is considered to be easily observable in an interaction. Similarly, different ratings by others are more likely, if the target person is self-biased because of a characteristic's positive evaluativeness in the general public, such as intelligence (facet of openness). Testing these assumptions provided support for the model. Recent studies reported higher agreement for conscientiousness and extraversion whereas raters agreement for emotional stability was low (Göllner, Roberts et al., 2017; Luan et al., 2017; Rohrer et al., 2018). Another explanation is seen in the relatively rapid personality change in adolescence compared to later life phases (e.g. Roberts & DelVecchio, 2000; Soto et al., 2011), as these need time to be perceived by others. Parents might notice developmental changes with a time lag to self-ratings (Rohrer et al., 2018).

Taken together, despite of rater differences, a substantial amount on adolescent personality research solely rely on parent reports (e.g., Brandes et al., 2020; De Bolle et al., 2012; De Fruyt et al., 2006), leaving the robustness of associations between adolescents' personality and third variables unclear. As both perspectives possess unique insights, multiple raters on adolescents' personality are valuable and needed (Soto et al., 2008; Vazire & Mehl, 2008).

To summarize the knowledge about personality development in adolescence, it becomes clear that adolescence is a unique developmental period we still know very little about. The Big Five personality factors seem to be less consistent with respect to their rank-order and also show different mean-level trajectories when compared to early adulthood. Although self-reports provide a valid source of personality measurement even in adolescence (Soto et al., 2008), parent-reports can provide additional knowledge on adolescents' personality. By systematically

investigating associations with crucial experiences, we can get closer to possible reasons for and associations with the shown disruptive and diverse developmental trends in adolescence.

### **Personality and Developmental Tasks in the Context of School**

Promising approaches to better understand antecedents and correlates of personality development in adolescence are the employment of a context-sensitive view and the consideration of age-specific tasks (Eccles & Roeser, 2011; Caspi et al., 2005; for adulthood see also, Huttemann et al., 2014). Throughout the world, schools play a significant role in the development agenda of young people and provide different developmental tasks referring to academic and social-emotional learning (Eccles & Roeser, 2010; Petersen & Leffert, 1995; Roeser et al., 2009; Weissberg et al., 2015). Together with concurrent changes in personality, it stands to reason that personality and school experiences are interrelated. In the following paragraphs, I review cross-sectional and longitudinal associations between personality and three proposed domains of developmental tasks in the context of school, that is academic achievement, social relationships, and psychosocial adjustment.

#### ***Personality and Academic Achievement***

Academic achievement is one of the first aspects when speaking about the context of school, as it is the key indicator of scholastic competences (Hartig & Klieme, 2006). Academic achievement is highly valued in westernized countries and often used as proxy for mental ability (Borghans et al., 2016; Nisbett et al., 2012). Moreover, it functions as feedback of a student's performance level (Trautwein et al., 2006) and was shown to be a valid predictor of later educational success (Sawyer, 2013; Trapmann et al., 2007; Westrick et al., 2015). Thus, striving for high academic achievement in school is crucial for educational transitions and decisions, as for example the university entrance (Anders et al., 2010; Martin et al., 2013). These findings underscore the necessity of learning how to deal with educational success and failure as one developmental task in adolescence (Havighurst, 1972; Hurrelmann & Quenzel, 2015).

**Operationalization and Measurement.** Usually, academic achievement is either operationalized as school grades or measured through objective standardized achievement tests. School grades are assigned on a subject-specific basis and typically aggregate written, oral, and behavioural performances of the student (Brookhart et al., 2016). In most cases objective standardized achievement tests measure one domain of general competences which are part of the scholastic curriculum, such as reading, writing or mathematics (Heckman & Kautz, 2014). Both achievement measures are moderately correlated,  $r$  ranging between .30 and .60 (Borghans et al., 2016). In comparison, school grades are seen as more subjective than

achievement tests due to other influencing factors of grading such as the teacher-student relationship or their personalities (Borghans et al., 2016; Lechner et al., 2017; Westphal et al., 2016). This is illustrated in differentiated associations with third variables (e.g. Borghans et al., 2016, Lechner et al., 2017; Spengler et al., 2013).

**Cross-Sectional Associations.** By now, a broad range of empirical studies, including several meta-analyses, have investigated associations between personality and academic achievement (e.g. Chamorro-Premuzic et al., 2010; Dumfart & Neubauer, 2016; Laidra et al., 2007; Lechner et al., 2017; O'Connor & Paunonen, 2007; Poropat, 2009; Spengler et al., 2013; Steinmayr & Spinath, 2007). Thereby, behavioural patterns associated with conscientiousness and openness emerged as particularly relevant (Chamorro-Premuzic, 2006; Dumfart & Neubauer, 2016; Heaven & Ciarrochi, 2008; Poropat, 2009; Spengler et al., 2013; Trautwein et al., 2009). Findings on the role of emotional stability, extraversion, and agreeableness were mixed. Further empirical studies, however, underscored that besides conscientiousness and openness being emotional stable (Chamorro-Premuzic & Furnham, 2003; Laidra et al., 2007) and agreeable (Laidra et al., 2007; Poropat, 2009) correlated with better school grades. Extraversion seemed to play a differentiated role because empirical results ranged from negative over null to positive associations (Brandt, Lechner et al., 2020; Bratko et al., 2006; Laidra et al., 2007; Lechner et al., 2017; O'Connor & Paunonen, 2007; Spengler et al., 2016).

Results also depend on the included achievement indicators, on the rater, and the investigated age span (Andersen et al., 2020; Brandt, Becker et al., 2021; Nofle & Robins, 2007; Poropat, 2014a; Tetzner et al., 2020). Hence, the Big Five show correlations with both introduced achievement indicators, whereby openness tended to higher associations with standardized achievement test, while conscientiousness was more strongly related to school grades (Brandt, Lechner et al., 2020; Nofle & Robins, 2007; Spengler et al., 2013). Regarding the rater, a recent study found differential associations between self-, parent, and teacher reports for different traits (Brandt, Becker et al., 2021). The comparison of two meta-analyses about personality and academic achievement, one including self-ratings (Poropat, 2009) and the other parent ratings (Poropat, 2014b), revealed more and higher effects of parent-rated personality on academic achievement (see also Poropat, 2014a). The investigated age group, however, differed in both analyses. Poropat (2014b) focused on primary school students and thus on younger age groups, whereas Poropat (2009) mainly included tertiary education levels and therefore older age groups. This supported the finding that especially in early adolescence, the majority of personality traits show substantial associations with both achievement indicators (Andersen et al., 2020; Poropat, 2009; Tetzner et al., 2020). Moreover, the linkage of academic achievement

with agreeableness (Poropat, 2009) and emotional stability (Andersen et al., 2020) was reported to be stronger in early adolescence compared to older age groups. These findings point to a possible age-differential role of personality.

**Longitudinal Associations.** So far, only few studies have examined the longitudinal interplay between personality and academic achievement. Existing longitudinal studies, however, included personality only as predictor (e.g., Heaven & Ciarrochi, 2008; Spengler et al., 2016), focused on late adolescence and transitions into young adulthood (e.g., Bleidorn, 2012; Lüdtke et al., 2011; Prevoe & ter Weel, 2015) or concentrated exclusively on conscientiousness (Brandt et al., 2019; Göllner, Damian, et al., 2017; Tackman et al., 2017). Conscientiousness was related to better school grades several years later (Heaven & Ciarrochi, 2008; Spengler et al., 2016). Conscientious behaviour in adolescence even predicted positive socioeconomic outcomes 18 years later, whereas a negative development of conscientiousness during adolescence yielded negative effects on these outcomes (Prevoe & ter Weel, 2015). Emphasizing the central role of conscientiousness at school, homework effort was linked to absolute changes in conscientiousness from 5<sup>th</sup> to 8<sup>th</sup> grade (Göllner, Damian, et al., 2017), whereas academic engagement showed no associations with intra-individual changes in impulse control, a facet of conscientiousness (Brandt et al., 2019). In fact, Tackman et al. (2017) reported correlated change (i.e., a joint development over time; Allemand & Martin, 2017) between school grades, school engagement and conscientiousness between the ages 10 and 16. A closer look at the transitional phase out of school revealed a significant mean-level increase in conscientiousness that was predicted by achievement behaviour (Bleidorn, 2012). The study also reported a joint development of achievement behaviour and all traits except for agreeableness (Bleidorn, 2012). Furthermore, after leaving school the occurrence of academic related positive and negative life events explained absolute change in all Big Five traits (Lüdtke et al., 2011). Accordingly, mainly conscientious behaviours emerged as valuable asset for achievement in longitudinal studies.

To summarize, the link between personality, especially conscientiousness, and academic achievement has been well established. Most cited evidence above was, however, either of cross-sectional nature or included personality as a (fairly stable) predictor and investigated later phases of adolescence. Research comparing early with late adolescence, however, point to different association patterns (Andersen et al., 2020; Poropat, 2009; Tetzner et al., 2020). Further studies are necessary to disentangle the longitudinal interaction between all Big Five and academic achievement, also including the early phase of adolescence.

### ***Personality and Social Relationships***

Rooted in the fundamental need to belong (Baumeister & Leary, 1995), well-functioning social relationships are crucial for one's mental and physical well-being and affect cognitive, emotional and behavioural processes (Cohen, 2004; Goswami, 2012; Hartup, 1989; Kuiper et al., 2016; Reis & Collins, 2004). Furthermore, who we are and how we behave, i.e. a person's personality, is inevitably interwoven with interpersonal relationships and interactions (e.g., Back et al., 2011; Deventer et al., 2019; Finn et al., 2017; Lang et al., 2006; Neyer et al., 2014; Parker et al., 2012; Wagner et al., 2014). School is one of the main social contexts in an adolescent's life that confronts students with new social roles outside their homes (Denissen et al., 2013; Hamm & Zhang, 2010; Osterman, 2000). Supportive relationships provide an opportunity for the development of cognitive, social, and emotional competences (Asher & Parker, 1989; Rubin et al., 2006), and can offer resources for adjusting to school requirements (Mashburn & Pianta, 2006; Smyth, 2016).

**Operationalization and Measurement.** To operationalize social relationships (Mund et al., 2016), one can differentiate between the type of social relationship dependent on the interaction partner (e.g. parental, romantic, professional, etc.), to assess quality aspects (e.g. closeness, social support, cohesion, etc.), quantity aspects (e.g. network size, time spent together, etc.), or to measure social behaviour in a broader sense (e.g. helpfulness, aggressiveness, etc.). Importantly, since relationships can be defined as a reciprocal, repeated, dynamic, and relatively stable interaction pattern of at least two people (Asendorpf & Bause, 2000; Hinde, 1979), all relationship actors influence the relationship and possibly perceive it differently (Fletcher et al., 2000; Kenny et al., 2006). Therefore, including both or several perspectives on the relationship is viewed as a promising approach (Mund et al., 2016). Peer contacts are gaining importance (Arnett, 1999; Somerville, 2013) and, consequently, friendships and social behaviours among peers deserve a closer look for the understanding of an adolescent's personality development (van Aken & Asendorpf, 2018). Furthermore, teacher-student relationships were shown to be relevant for a student's development, both personally as well as academically (Aldrup et al., 2018; Hamre & Pianta, 2001; Roorda et al., 2011; Wentzel, 2010). Although less dominant in the context of school, parenting is still linked to their children's performance in school (Castro et al., 2015; Pinquart, 2016) as well as to their personality development (Asendorpf & van Aken, 2003; Branje et al., 2004).

**Cross-Sectional Associations.** In several studies during early adolescence, extraverted, agreeable and conscientious behaviour predicted more positive interaction patterns with others and better friendship quality (Jensen-Campbell et al. 2002; Jensen-Campbell et al. 2003;

Jensen-Campbell & Malcolm, 2007). Interestingly, in early adolescence, agreeableness was dominantly associated with social relationships (Jensen-Campbell et al., 2002). In late adolescence and (emerging) adulthood, however, the supposedly most obvious social trait extraversion gained positive importance and predicted popularity, the size of social networks, and relationship satisfaction (Asendorpf & Wilpers, 1998; Harris et al., 2017; Harris & Vazire, 2016; Selfhout et al., 2010; Wagner et al., 2014; Zhu et al., 2013). As a result, agreeableness and extraversion seem to have differentiated functions. Agreeableness is more related to the other-oriented empathy aspect, e.g. leading to being selected as friends, whereas extraversion is linked to actively shaping one's social life, e.g. by selecting friends (Penner et al., 1995; Selfhout et al., 2010; Wagner et al., 2014). Besides the establishment of positive peer relationships, adolescence is also a time during which antisocial behaviour increases (Farrington, 1995). Especially low levels of emotional stability, agreeableness, and conscientiousness have been associated with antisocial behaviour (Jensen-Campbell & Malcolm, 2007; Möttus et al., 2012; Shiner, 2000; Tackett et al., 2014).

Studies linking students' personalities and the teacher-student relationship are rare. A few studies, however, have investigated this association but solely focused on childhood, included mainly teacher reports, or investigated mostly other personality aspects than the Big Five, such as temperament (Rudasill & Rimm-Kaufmann, 2009; Saft & Pianta, 2001; Thijs & Koomen, 2009). For instance, in early elementary school, shy children had overall less interactions with their teachers and showed less conflictual but also more distant teacher-student relationships (Rudasill & Rimm-Kaufmann, 2009). From the teacher perspective, students showing extraverted behaviour without behavioural problems were generally favoured (Thijs & Koomen, 2009). As temperament scales mainly relate to emotional stability, extraversion, and conscientiousness (Mervielde et al., 2005; Rothbart, 2007), the role of openness and agreeableness remains particularly unclear. Providing initial indications, Zee and colleagues (2013) examined the Big Five and included student and teacher perspectives on their relationship. Results revealed that students with higher levels of emotional stability, agreeableness, and conscientiousness had close, non-conflictual relationships with their teachers. Extraversion again takes on an ambivalent role because of its simultaneous association with more conflict and greater closeness (Zee et al., 2013).

Core aspects of parent-children relationships are reflected in the warmth or hostility that parents express towards their children as well as in key social interaction qualities such as family cohesion (Baumrind, 1971; Feldman & Gehringer, 1988). Parents scoring higher on all Big Five traits provided a more supportive family environment (Prinz et al., 2009). With

respect to adolescents' personalities, higher levels of emotional stability, agreeableness, and conscientiousness have been related to generally warmer, more supportive and less controlling parenting (Denissen et al., 2009; O'Connor & Dvorak, 2001; Prinzie et al., 2004). Mixed findings emerged with regard to extraversion and openness (De Haan et al., 2012; Denissen et al., 2009; O'Connor & Dvorak, 2001). As the parent-child relationship during adolescence is also characterized by a growing adolescent striving for independence (Collins & Steinberg, 2006), research also suggested that the effects of adolescent personality increase as adolescence progresses (Denissen et al., 2009).

**Longitudinal Associations.** As social relationships are almost always a central part of people's environment, it stands to reason that they are a source of personality development as well (e.g., Back et al., 2011; Neyer et al., 2014). A few longitudinal studies investigated the reciprocal interplay between the Big Five and social relationships over time in adolescence, albeit mainly in the context of the family (Asendorpf & van Aken 2003; Brandt et al., 2019; Branje et al., 2004; Greischel et al., 2016; Klimstra et al., 2010; Tackman et al., 2017; van den Akker et al., 2014). Whereas higher levels of extraversion predicted support from peers over a time span of five years (from 12 to 17), support did not predict relative personality change (Asendorpf & van Aken 2003). Correlated change was found for extraversion and agreeableness (Asendorpf & van Aken 2003) as well as for conscientiousness (Tackman et al., 2017) with peer support. A similar interconnectedness emerged when looking at aggression: Open, agreeable, and conscientious students showed less aggressive behaviour after at least one year, whereas higher levels of aggression had negative effects on later emotional stability and agreeableness (Klimstra et al., 2010). Moreover, aggression and all Big Five factors, except for extraversion, changed together (Klimstra et al., 2010).

With respect to teacher-student relationships, very little is known about the longitudinal interplay with students' personalities. Investigations of correlated change and cross-lagged effects of impulse control and teacher support revealed that teacher support was related to increases in impulse control between the ages of 14 and 16 (Brandt et al., 2019).

Regarding relationships with parents, an adolescent's extraversion, agreeableness, and openness had positive effects on mean-level change in parenting, whereas parenting predicted absolute change in conscientiousness and emotional stability (van den Akker et al., 2014). A joint development emerged for family support with all personality traits but was most pronounced for agreeableness (Branje et al., 2004; van den Akker et al., 2014).

To summarize, only few studies that focused on adolescence included all Big Five traits, integrated different school context specific relationship indicators or investigated their interplay

longitudinally and reciprocally. The existing literature, however, points to a general relevance of personality favouring different traits dependent on the social relationship characteristic. It can be noted that, first, correlated change was more likely to be observed than reciprocal cross-lagged effects over time. Second, traits showing significant cross-lagged effects did not necessarily also show correlated change. Third, similar to adulthood effects of personality on later social relationships, characteristics were more often reported than effects on personality development.

### ***Personality and Psychosocial Adjustment***

School takes a central position in shaping adolescents' psychosocial outcomes, as the environment school provides the possibility to fulfil basic psychological needs (Eccles & Roeser, 2010; Rutter, 1980). On the one hand, with respect to the development of a value system and the identity exploration, psychosocial adjustment can be understood as one developmental task in adolescence (Erikson, 1968; Grob & Jaschinski, 2003; Hurrelman & Quenzel, 2018). On the other hand, as developmental tasks are not clearly differentiable, the (un)successful mastering of further developmental tasks contributes to a person's psychosocial adjustment (Roeser & Eccles, 1998; Wentzel, 2003). Underscoring the necessity to foster positive psychosocial development, empirical evidence supports the broad interconnectedness between psychosocial adjustment and diverse school success indicators, relationship functioning, social-emotional learning, and personality (Antaramian et al., 2010; Domitrovich et al., 2017; Hakvoort et al., 2010; Nansel et al., 2001; Piqueras et al., 2019; Scholte et al., 2005; Wang & Eccles, 2012).

**Operationalization and Measurement.** Psychosocial adjustment is defined as ability to adapt to environmental settings, including the availability of mechanisms to positively influence one's well-being, to be integrated, as well as to adequately react to and fulfil new requirements (Piqueras et al., 2019). This definition includes a variety of aspects related to psychological well-being and health. Regarding the investigated adolescent life phase and the school setting, I focused on direct school-related aspects such as well-being in school and school belonging. Well-being in school as part of a successful adaptation encompasses the overall emotional and cognitive evaluation of one's school experiences (Bird & Markle, 2012; Murray-Harvey, 2010; Renshaw et al., 2015). The adjustment indicator school belonging refers to the sense of connectedness at school and to the wish of being integrated as well as socially accepted (Goodenow & Grady, 1993). Additionally, I considered broader aspects such as self-esteem and mental health as well-established indicators of adjustment (Gómez-Ortiz et al., 2018; Lent, 2004; Pope et al., 1988). Self-esteem is the overall positive or negative evaluation



of the self (DuBois et al., 1998), whereby health can be understood as the physiological conceptualization of daily difficulties and stress (Kaplan, 2017; Low et al., 2012). These more general operationalizations illustrate that psychosocial adjustment at school can generalize to miscellaneous life.

**Cross-Sectional Associations.** Research on the association between the Big Five personality factors and psychosocial adjustment has proven their linkage across the life span with different adjustment indicators such as well-being, self-esteem, and health (Anglim et al., 2020; Friedman & Kern, 2014; Robins et al., 2001). Possible association directions for this well-supported link are threefold (Shiner & Caspi, 2003; Ozer & Benet-Martínez, 2006). First, some personality characteristics are associated with less well-being or increased illness (e.g. being angry and hostile – low agreeableness; Miller et al., 1996). Second, personality characteristics can prevent maladjustment and health-damaging behaviours (e.g., acting responsibly like not smoking - high conscientiousness; Stephan et al., 2019). Third, personality can be associated with differences in handling stress (being extremely anxious and showing negative affect – low emotional stability; e.g. Smith & Spiro, 2002).

The role of an adolescent's personality for adjustment in school, specifically well-being in school and school belonging, was less focused on (cf. Lucas, 2018; Steel et al., 2008). Two recent studies addressed this gap and found that student self-reported openness, agreeableness, and conscientiousness as well as parent-reported conscientiousness were related to well-being in school (Evans et al., 2018; Perret et al., 2019). Extraversion showed a quadratic effect, indicating lower well-being reports of highly introverted and highly extraverted students. Interestingly, in contrast to findings for general subjective well-being, emotional stability did not explain differences in school well-being (Perret et al., 2019). Findings about the better investigated construct of subjective well-being also supported the relevance of the traits extraversion and conscientiousness together with emotional stability (Butkovic et al., 2012; Garcia, 2011). Taking a closer look on the antecedents of school belonging, a meta-analysis revealed that next to teacher support, positive personal characteristics are the best predictors (Allen et al., 2018). These positive characteristics encompassed emotional stable, agreeable, and conscientious behaviours. Underscoring the scarce evidence, the meta-analysis of Allen and colleagues (2018) was not able to include even one study that investigated the association between the Big Five and school belonging.

With respect to associations between adolescents' personality and the more general psychosocial adjustment indicators self-esteem and health, the state of research is more promising (Butkovic et al., 2012; De Fruyt et al., 2017; Friedman et al. 1995; Hair & Graziano,

2003; Hampson, 2019; Tian et al., 2019). People reporting a higher self-esteem have been found to be also more emotional stable, extraverted, and conscientious, and to a lesser extent, more open and agreeable regardless of age, gender, socio-economic status or ethnicity (Robins et al., 2001). The high interrelatedness was also supported in pure adolescent samples with data collection in the context of school (Butkovic et al., 2012; Hair & Graziano, 2003). In their review including different health outcomes, De Fruyt and colleagues (2017) emphasized emotional stability and conscientiousness as the best positive predictors for general health in childhood and adolescence. Another study investigating Chinese students additionally supported the positive role of extraversion for mental health (Tian et al., 2019). Thus, the relevant traits for health in adolescence are the ones including greater positive affect, i.e. emotional stability and extraversion (Finch et al., 2012), as well as a responsible handling of one's own health, i.e. conscientiousness (Friedman et al., 1995).

**Longitudinal Associations.** Although personality was mainly investigated as predictor of psychosocial adjustment, the causal nature of this association remains unclear (Caspi et al., 2005; Jackson et al., 2017; Ozer & Benet-Martínez, 2006). Psychosocial adjustment could also foster personality changes by influencing a person's possible set of behaviours, thoughts, and emotions (Jackson et al., 2017). For example, an adolescent who does not enjoy being in school will display a completely different behaviour than someone who enjoys school. A few recent studies demonstrated a longitudinal interplay between personality and adjustment indicators (Brandt et al., 2019; Borghuis et al., 2020; Tackman et al., 2017). Focusing on conscientiousness, research illustrated a joint development with positive school climate, school engagement, and more general health indicators such as depression and physical activity (Tackman et al., 2017). Moreover, correlated change was found for impulse control and school satisfaction, whereby school satisfaction also predicted subsequent impulse control (Brandt et al., 2019). Investigations of the longitudinal interplay of emotional stability and negative affect over a six-year period during adolescence indicated negative cross-lagged effects in both directions on negative affect and on emotional stability (Borghuis et al., 2020).

In sum, psychosocial adjustment is central in adolescence as it forms diverse aspects of school experiences. Whereas most research investigated cross-sectional and longitudinal interrelations between all Big Five and diverse adjustment variables in adulthood (e.g., Caspi et al., 2005; Fetvadjev & He, 2019; Hill et al., 2012; Letzring et al., 2014; Mund & Neyer, 2016), the research review in adolescence reveals a gap with respect to the inclusion of all Big Five personality traits and specific school-related conceptualizations of adjustment. A greater

understanding of their longitudinal associations could provide entry points for more positive developments and better school experiences (Hampson, 2019).

### Research Desiderata

Adolescence is a period of change in many ways: Personality, just like other important academic and social-emotional characteristics, fluctuate and, thus, might turn adolescence into a turbulent period (Arnett, 1999; Hall, 1904; Rutter, 1995). Despite the need for knowledge about resources and related factors of significance for successfully managing developmental tasks, the review of the current state of personality research in adolescence revealed at least three limitations and open questions.

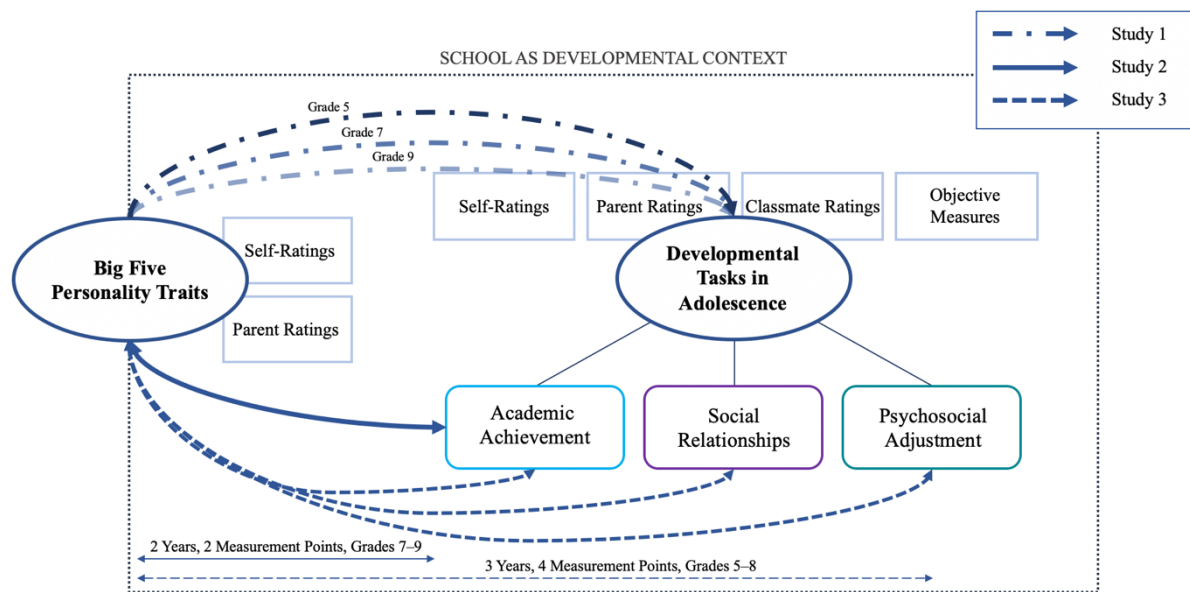
First, focusing on personality, adolescence is an insufficiently researched time span, particularly regarding longitudinal studies. This becomes especially clear when comparing the state of research with knowledge in adulthood and holds true both theoretically as well as empirically. Research support the assumption that personality in adolescence develops differently than in adulthood (e.g., Borghuis et al., 2017; Denissen et al., 2013) but so far, no existing theory includes personality development in adolescence (cf. Back et al., 2011; Roberts & Nickel, 2017; Wrzus & Roberts, 2017). The adjoining of information of related research fields as well as more empirical age-differential and longitudinal information are needed to understand adolescents' personality development. Thus, all three studies of this dissertation focus on the especially understudied period of adolescence. Hence, *study 1* examines cross-sectional but age-differential associations between adolescents' personality and a wide range of different age-related correlates. In *study 2* and *study 3* I investigate personality development across two and four measurement points, respectively, and aim at revealing the potential longitudinal interplay with different developmental tasks.

Second, the potential protective or detrimental role of personality for the mastering of developmental tasks and thus psychosocial functioning variables in adolescence remains unclear. A plethora of research in adulthood emphasize the predictive power of personality for diverse outcomes over the whole adult life span (e.g., Roberts et al., 2007; Ozer & Benet-Martínez, 2006). Therefore, it should be promising to investigate the relevance of personality for adolescents' psychosocial functioning, cross-sectionally and longitudinally. Previous research often focused on only one trait, one rater perspective or a specific outcome (e.g., Göllner, Damian et al., 2017; Tackman et al., 2017) leaving a bigger picture and an overall understanding on the role of personality unclear. To address this research gap, all three studies

include the five personality factors, different measures or rater perspectives, and a wide range of developmental tasks.

Third, in accordance with the findings of developmental and educational researchers, personality as a central marker of each adolescent should indisputably interact with the school environment (Baltes et al., 2006; Eccles & Midgley, 1989; Eccles & Roeser, 2010). Thus, personality can function as an important resource for a successful school career, and school with its broad educational mission plays an essential part in who adolescents become and how they will develop. Understanding this interplay provides a great chance to identify starting points in order to improve school experiences and to support an adolescent's development. Therefore, the three dissertation studies take a closer look at the role of personality within the context of school.

Based on the identified research gaps, I aim at understanding the role of personality for mastering school-related developmental tasks and identifying the experiences that contribute to personality development in adolescence. Therefore, I investigate the cross-sectional and longitudinal interplay between personality and three domains of developmental tasks by analysing three different educational large-scale panel data sets. For a more comprehensive picture of the developmental context, I include different rater perspectives on adolescents' personalities and the perception of developmental tasks. Moreover, to account for methodological specificities in measuring personality in adolescence, previous research suggested different methods, such as the use of latent variable modelling, measurement invariance testing, and the consideration of acquiescence responding, which I implement whenever possible. Figure 3.1 provides a simplified overview about the content of this dissertation project.



**Figure 3.1** A simplified schematic representation of the three dissertation studies.

### Study 1

As a starting point, *study 1* aims at presenting a detailed cross-sectional overview about the interrelatedness between the Big Five and a diverse set of school experiences in the three main areas of developmental tasks: achievement, social relationships, and psychosocial adjustment. Based on theories from the personality, developmental, and educational field indicating an interaction between persons' characteristics and their environment, I expect adolescents' personalities to relate to their school experiences. As previous findings point to a potentially changing role of personality during adolescence (e.g., Andersen et al., 2020; Poropat, 2009; Tetzner et al., 2020), I investigate these associations in three different cohorts across adolescence, namely in grades 5, 7, and 9. Another remaining open question concerns the comparability of different rater perspectives on adolescents' personalities when investigating personality associations (e.g. Vazire & Mehl, 2008; Brandt, Becker et al., 2021). Thus, all associations are also examined from two different perspectives, that are self- and parent reports, described in the Neo-Socioanalytic Model as identity and reputation (Roberts & Nickel, 2017). Depending on the SOKA model (Vazire, 2010), I expect similar association patterns between raters for better observable and less evaluative traits (i.e. extraversion). Moreover, it is statistically investigated if associations differed between cohorts and raters. A large dataset of students and their parents (EIKA study;  $N = 2,667$ ; student  $M_{\text{agegrade5}} = 11$  year) is analysed to address these research aims. For data preparation, a multiple imputation approach is implemented to account for the, in some instances relatively large, number of missing values.

Furthermore, measurement invariance between grades and between raters is established. To calculate the personality associations, I conduct latent regression analyses based on multigroup CFA models. By including and combining all Big Five personality traits as well as different psychosocial aspects, age- and rater-differences, this study is one of the first to provide an overview about the role of personality in adolescence. The similarities or differences provide knowledge about a potential age-related role of personality and possible rater-specific insights on adolescents' personality. Moreover, the findings yield information about experiences in school that potentially loop back to personality development and, thus, build the foundation for study 2 and 3.

## Study 2

*Study 2* put a focus on the interplay between personality and the developmental task of performing well in school. Students' personalities are related to academic achievement, whereby each of the Big Five personality factors contributes in a different way to educational success (De Raad & Schouwenburg, 1996). I expect the experience of educational success, operationalized as school grades and objective achievement tests, to be one possible predictor of relative personality change across school life. As parents still represent decisive social interaction partners for adolescents, the relationship to them could additionally contribute to adolescents' development as well as to their academic achievement in school (Asendorpf & van Aken, 2003; Pinquart, 2016). Therefore, family cohesion from different perspectives is included to investigate its role for change in personality and achievement. Although personality, achievement, and parenting have been linked cross-sectionally, the role of relative change within this association still represents an open question. Drawing on the large National Educational Panel Study (NEPS;  $N = 4,355$ ,  $M_{\text{ageT1}} = 12.9$  year), I examine cross-lagged panel models to, firstly, replicate cross-sectional findings between personality and achievement, secondly, test correlated change and reciprocal effects of personality on academic achievement two years later and vice versa and, thirdly, investigate the predictive role of family cohesion for personality and achievement change. Study 2 is one of the first to test the interplay between personality and one developmental task domain longitudinally. Considering the relationship over time can provide information about the extent of personalities' relevance for achievement experiences and could reveal if developmental tasks at school are relevant factors for explaining relative personality changes in adolescence.

### Study 3

The first and second study reveal the need for more measurement points and the investigation of the longitudinal interplay between personality and additional social-emotional domains. Therefore, in *study 3* I additionally investigate the longitudinal interplay of personality with social relationships and psychosocial adjustment to understand better antecedents and consequences of adolescents' personality development in the context of school (Eccles & Roeser, 2011). Drawing on specified theories from the fields of personality, developmental, and educational psychology, I include seven school-related experiences comprising developmental tasks of academic achievement, social relationships, and adjustment (e.g. Erikson, 1959; Havighurst, 1972). I expect first, to support the relevance of conscientiousness and openness for academic achievement over time. Second, emotional stability, extraversion, and agreeableness should be longitudinally interrelated with school-related social relationships. Third, I expect emotional stability, extraversion, and conscientiousness to show longitudinal associations with adjustment. I analyse data from the TRAIN study ( $N = 3,473$ ,  $M_{\text{ageT1}} = 11.1$  years), covering a time span of three years with four measurement points, based on preregistered hypotheses and procedures. Based on invariant measurement models across time and controlling for acquiescent responding, I estimate bivariate latent growth curve models and cross-lagged panel models. These procedures allow to test for a co-development and for longitudinal reciprocal associations between personality and school experiences in adolescence. Study 3 is one of the very first to investigate the longitudinal interplay between all Big Five personality traits and different school-related experience across multiple measurement points covering the time span of early to middle adolescence. By including the five personality traits and three domains of developmental tasks, the relevance of traits and tasks for a positive development can be compared, and thus, help to disentangle developmental patterns in the context of school.





# *Chapter 2*

## **Study 1**

Personality and Psychosocial Functioning in Early Adolescence: Age-Differential Associations from the Self- and Parent Perspective

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The official citation that should be used in referencing this material is:

Israel, A., Brandt, N. D., Grund, S., Köller, O., Lüdtke, O., & Wagner, J. (2021). Personality and psychosocial functioning in early adolescence: Age-differential associations from the self- and parent perspective. *European Journal of Personality*.  
<https://doi.org/10.1177/08902070211005636>

This is the authors accepted manuscript of an article published as the version of record in the *European Journal of Personality*. Please do not copy without authors permission. The final article is available at <https://doi.org/10.1177/08902070211005636>.



### **Abstract**

Although psychosocial functioning and personality are indisputably interrelated in adulthood, much less is known about these associations in early adolescence. Accordingly, the goal of the current study was twofold. First, we investigated associations between adolescents' personality and three broad indicators of psychosocial functioning: academic achievement, social relationships, and psychosocial adjustment. Second, we tested differential effects by comparing these associations across three different cohorts (Grades 5, 7, and 9) and across two raters of adolescents' personality: self- and parent reports. Our sample consisted of  $N = 2,667$  students and their parents. According to latent regression models, adolescents' personality traits showed significant associations with all psychosocial functioning variables: Achievement was most consistently associated with emotional stability, openness, and conscientiousness; social relationships were most consistently associated with agreeableness and conscientiousness; and psychosocial adjustment was related to all of the Big Five traits. Most associations did not vary across grades, whereas self-reported extraversion showed lower associations in later grades. Looking at rater-specific effects, we found fewer and usually smaller associations with parent- than with self-rated personality, again with the most significant differences with extraversion. We discuss the consistent interrelatedness between adolescents' personality and psychosocial functioning but also highlight important exceptions in grade- and rater-specificities.

*Keywords:* personality, adolescence, psychosocial functioning, age differences, other ratings



## **Personality and Psychosocial Functioning in Early Adolescence: Age-Differential Associations from the Self- and Parent Perspective**

Both conceptual and empirical research emphasize the importance of personality as an adaptive capacity for positive life outcomes across the entire adult lifespan (Caspi et al., 2005; Ozer & Benet-Martínez, 2006; Roberts et al., 2007; Soto, 2019). But what about earlier phases in life? Much less is known about how personality is related to key aspects of psychosocial functioning during adolescence. Once labeled a phase of “storm and stress” (Arnett, 1999), adolescence is characterized by the need to face diverse tasks such as striving for academic success, establishing positive relationships, and generally developing social-emotional skills to adjust to these demands (Caspi et al., 2005; Eccles & Roeser, 2011; Hogan & Roberts, 2004; Weissberg et al., 2015). It is still unknown whether adaptive capacities such as personality traits promote the mastery of developmental tasks and how these accomplishments loop back to personality in adolescence (for a review, see De Fruyt et al., 2017). This lack of empirical research is even more pronounced when looking for age-sensitive associations of personality and psychosocial functioning across the disruptive phase of early to middle adolescence and when comparing different raters’ perspectives.

Previous research has suggested that assessments of the Big Five personality traits (i.e., emotional stability, extraversion, openness, agreeableness, and conscientiousness; McCrae & Costa, 1987) are comparable from adolescence through adulthood (Brandt, Becker et al., 2020; Soto et al., 2008). This finding provides a starting point for identifying age-differential associations between personality and diverse indicators of psychosocial functioning. Indeed, initial evidence obtained from a moderator analysis of a meta-analysis indicated that personality-achievement associations can differ across adolescence (Poropat, 2009) and also appear to differ across raters (e.g., Poropat, 2014a, 2014b; Vazire & Mehl, 2008). To investigate age-differential associations in achievement and other measures, we analyzed the interrelatedness between personality and relevant indicators of psychosocial functioning from two rater perspectives. We used data from  $N = 2,667$  adolescents and their parents ( $N = 1,959$ ) from Grades 5, 7, and 9 to examine differential associations between the Big Five personality traits and three sets of psychosocial functioning variables.

## **Personality and Psychosocial Functioning in Adolescence**

The first phase of adolescence (10- to 15-year-olds) has long been recognized as a distinctive developmental period (Hall, 1904) with unique growth stages (Caskey & Anfara, 2014), thus inspiring early developmental stage theories (Coleman, 1974; Erikson, 1959; Havighurst, 1956). To achieve successful development and psychosocial functioning, adolescents have to master different developmental tasks. Developmental tasks can be defined as age-graded normative duties that are linked to societal expectations and should thereby be reached in certain life stages (Havighurst, 1956; Hurrelmann & Quenzel, 2018; Hutteman et al., 2014). Although different theories name different tasks, they all agree that developmental tasks are related to age-graded environmental and contextual conditions (Robin & Foster, 1989).

There are three developmental tasks that most theories agree on: First, an academic qualification is needed to become increasingly independent, to feel competent, and to make a valuable contribution to society (Erikson, 1959; Hurrelmann & Quenzel, 2018). Second, it is increasingly important to establish positive social relationships with peers and people outside of one's family (Coleman, 1974; Havighurst, 1956; Hurrelmann & Quenzel, 2018). Third, the exploration of the self is initiated with the goals of self-acceptance and building an identity (Erikson, 1959; Havighurst, 1956). According to developmental stage theories, the successful accomplishment of all of these tasks should be related to better psychosocial adjustment (Havighurst, 1956; Pinquart et al., 2004).

As psychosocial functioning covers people's general quality of life (e.g., Lucas, 2018), it has the power to generalize to diverse contexts of life. Therefore, it is very important to understand the potential protective or detrimental role of personality for psychosocial functioning in adolescence. Given the plethora of research and the consistent findings on the importance of personality for all three domains of psychosocial functioning (i.e., achievement, social relationships, and psychosocial adjustment) to changes in adulthood (Caspi et al., 2005; Hutteman et al., 2014; Ozer & Benet-Martínez, 2006; Roberts et al., 2007; Soto, 2019), there is reason to presume that personality is also a key factor for the successful mastery of developmental tasks and, thus, for good psychosocial functioning in adolescence. However, research linking personality and developmental tasks in adolescence is still scarce. With the present study, we aim to provide a comprehensive age-differential overview of personality associations in the first phase of adolescence with three broad indicators of psychosocial functioning. Moreover, we aim to extend the existing literature by including multiple informants on personality and psychosocial functioning variables by controlling all associations

for important covariates and by investigating a heterogeneous sample with respect to educational and personal background. In the following paragraphs, we summarize the existing literature on associations between adolescents' personality and their achievement, social relationships, and psychosocial adjustment.

### ***Personality and Achievement***

In school, where adolescents spend a large amount of time (Rutter et al., 1979), one essential developmental task refers to achievement. Adolescents are confronted with increasingly more experiences of (in)competence and (in)ability, for which they get feedback through school grades. Accordingly, adolescents have to learn how to deal with success and failure and get prepared for later work life (Hutteman et al., 2014). Although associations between personality and achievement are relatively well-studied in later adolescence, findings in early adolescence are scarce.

Accumulating evidence on the relevance of personality for educational success (e.g., Borghans et al., 2016; Lechner et al., 2019; O'Connor & Paunonen, 2007; Poropat, 2009), which has primarily been operationalized by school grades and achievement tests, has supported the crucial role of conscientiousness and openness in middle and late adolescence (Dumfart & Neubauer, 2016; Spengler et al., 2013; Trautwein et al., 2009). Comparing different achievement indicators, research has illustrated a strong association between conscientiousness and school grades, whereas openness is more closely related to objective achievement tests (Borghans et al., 2016; Spengler et al., 2016). With respect to the remaining traits, results are less consistent. Meta-analyses have reported that being more agreeable is associated with better academic achievement (Poropat, 2009; Laidra et al., 2007), although other studies have found negative associations (Brandt, Lechner et al., 2020; Lechner et al., 2017). Low emotional stability has been proposed to be a vulnerability factor (Laidra et al., 2007; Lechner et al., 2017). Such associations have not been found to be robust, with other studies reporting null effects (O'Connor & Paunonen, 2007; Spengler et al., 2016). Similarly, mixed findings, ranging from slightly positive to slightly negative, have emerged for extraversion (Israel et al., 2019; Laidra et al., 2007; Lechner et al., 2017). Despite this evidence in middle and late adolescence (including 14- to 20-year-olds), there is initial empirical evidence that personality-achievement associations differ in early adolescence (Israel et al., 2019; Laidra et al., 2007). In contrast to middle and late adolescence, findings indicate that all Big Five personality traits seem to be relevant for achievement. Thus, early adolescence is still an underrepresented age group in existing studies.

### ***Personality and Social Relationships***

Based on developmental task theories, research has increasingly emphasized the importance of new social contexts and relationships for adolescence (Coleman, 1974; Hurrelmann & Quenzel, 2018). With school as a main social context, adolescents strive to be accepted by their peer group (Kloep, 1999; Reitz et al., 2014) but also to have a supportive relationship with their teacher (Mashburn & Pianta, 2006; Roorda et al., 2011). In contrast to research on personality-achievement associations and despite the fact that the Big Five personality traits have been found to be key predictors of social functioning throughout the adult lifespan (Back et al., 2011; Mund et al., 2018), much less is known about the role of personality in adolescents' relationship functioning in adolescence (Jensen-Campbell et al., 2002; Jensen-Campbell et al., 2003; Jensen-Campbell & Malcolm, 2007; Möttus, et al., 2012; Tackett et al., 2014). In this study, we decided to investigate peer relationships (rated by peers) and the teacher-student relationship (rated by the student) as indicators of social relationships in a typical adolescent context, that is, school.

With respect to positive peer interactions, agreeable and conscientious fifth- and sixth-graders tend to show more harmonious and constructive conflicts and higher friendship quality (Jensen-Campbell et al., 2003; Jensen-Campbell & Malcolm, 2007). Conversely, low levels of emotional stability, agreeableness, and conscientiousness have been associated with more antisocial behavior both in early adolescence (Jensen-Campbell & Malcolm, 2007) and in a sample spanning all of adolescence (age span: 11 to 20 years; Möttus et al., 2012). Besides low emotional stability and low conscientiousness, low openness has been found to be associated with relational aggression among children (Tackett et al., 2014). Across studies, the informants who rated relationship characteristics have varied substantially: This last study relied only on parent reports, whereas others have also included self-perceptions or even peer reports. In general, peer reports might be particularly informative in an interaction setting where parents are not present. Accordingly, we focused on peer reports of perceptions of helping behavior and antisocial behavior in the classroom.

Apart from peers, adolescents are also in need of building a good teacher-student relationship as there is growing evidence on the importance of students' school experiences, their educational success, and their psychosocial functioning (Aldrup et al., 2018; Hattie, 2009; Pianta & Hamre, 2009; Roorda et al., 2011). Less is known about the extent to which this relationship is associated with students' personality. We are only aware of one correlational study in adolescence: Zee et al. (2013) found positive associations of emotional stability,



agreeableness, and conscientiousness with positive nonconflictual teacher-student relationships. Furthermore, mixed findings have emerged for extraversion, which predicted closer but also more conflictual relationships with teachers.

### ***Personality and Adjustment***

Adolescents are confronted with a variety of developmental tasks that can shape their well-being and health (Pinquart et al., 2004; Vanlede et al., 2006). The degree of success (or failure) in dealing with a variety of tasks is most likely reflected along the lines of variables of adjustment: in adolescents' self-esteem as the general evaluation of the self (DuBois et al., 1998), in how much they enjoy school as one of the most task-laden developmental contexts (Shoshani & Slone, 2013), and in their physical health as a mirror of daily difficulties and stress (Low et al., 2012). In adulthood, personality traits have been found to be associated with all three adjustment variables (i.e., general self-esteem, well-being, and health; Anglim et al., 2020; Friedman & Kern, 2014; Robins et al., 2001), but research on adolescents is scarce. Butkovic et al. (2012) identified emotional stability and extraversion as the most consistent predictors of self-esteem, subjective well-being, and loneliness among adolescents aged 16 to 19 years. Furthermore, conscientiousness was identified as another positive predictor of well-being among 17-year-old adolescents (Garcia, 2011). Health problems, which have been considered a physiological conceptualization of psychosocial adjustment (Kaplan, 2017), have been linked to lower emotional stability and lower conscientiousness in childhood and adolescence (De Fruyt et al., 2017).

In this study, we integrate different conceptualizations of psychosocial functioning that have largely been taken from the task-laden context of school and investigate the role of personality in the developmental phase of adolescence.

### **Investigating Age-Specific and Rater-Differentiated Associations in Adolescence**

Although recent research has pointed to a reliable assessment of self-reports in adolescence (Brandt, Becker et al., 2020; Soto et al., 2008), we would like to argue that such an investigation of the associations between personality and psychosocial functioning in this age group would additionally benefit from two further extensions: age/grade-differential associations and a multirater perspective on personality. This differentiated examination could provide a better understanding with respect to the robustness of associations across raters and age groups, thus disentangling previously mixed patterns.

### ***Age Differences in Personality Associations Across Adolescence***

Age-related differences and developmental trajectories in adolescent personality appear to be quite different from those known from young adulthood: Adolescent personality illustrates substantially lower rank-order stabilities in traits (i.e., the maintenance of the relative rank of individuals on a trait over time; Roberts & DelVecchio, 2000) and appears to diverge from trajectories of personality maturation (Roberts et al., 2006), with adolescents tending to show temporary dips in some personality aspects that are not yet well-understood (disruption hypothesis; Borghuis et al., 2017; Denissen et al., 2013; Soto et al., 2011; van den Akker et al., 2014). Furthermore, most developmental tasks are age-graded and thus, the corresponding aspects of psychosocial functioning of adolescents also differs between age groups: In early adolescence, school engagement, school grades, well-being, and levels of adjustment are generally higher than in middle or late adolescence (Coelho et al., 2020; González-Carrasco et al., 2017; Ronen et al., 2016; Wang & Eccles, 2012). Friendship quality, however, is reported to be lower in younger age groups (Lansford et al., 2014).

The few existing studies that have systematically investigated age-differential personality associations during adolescence have focused primarily on achievement. Particularly in late childhood and early adolescence, personality-achievement associations differ from findings in later adolescence and early adulthood, pointing to a potentially age-differential role of these traits in adolescence and young adulthood (Andersen et al., 2020; Poropat, 2009; Tetzner et al., 2020). For instance, being compliant may support learning progress in younger age groups, whereas developing an independent way of thinking by also disagreeing with teachers might be more beneficial in later years. Supporting this assumption, in younger age groups, agreeableness (Poropat, 2009) and emotional stability (Andersen et al., 2020) have shown stronger associations with academic achievement than in older age groups. Age-specific differences in associations may also occur because of different aspects covered by traits in different age groups. For instance, empirical research has indicated that some aspects of agreeableness and conscientiousness might still be linked with each other in young adolescents but not (or less so) in older adolescents or young adults (Soto & John, 2014; Soto & Tackett, 2015). Interestingly, this tendency was found in both self- and parent ratings, indicating that such a stronger trait-specific association might reflect a substantive overlap of traits instead of an undifferentiated reporting bias in younger students.

Age-differential effects in social relationships could furthermore be traced back to the development of new preferences for certain characteristics in social interaction partners. For

instance, whereas in early adolescence, it might be more beneficial for peer relationships to be friendly and compliant (i.e., agreeable) in middle adolescence, it might become increasingly beneficial to be popular among peers and, thus, to show outgoing, extraverted behavior (Lansford et al., 2014; Selfhout et al., 2008). In summary, it appears to be plausible to expect differences in associations between personality and psychosocial functioning across different phases of adolescence.

### ***Self- and Parent Reports of Personality in Adolescence***

Parent ratings can offer a useful approach for getting a more comprehensive picture of personality in adolescence. Parents, as close others, are generally used as personality judges across childhood because they know their children well (Funder, 2012; Tackett, 2011; Watson et al., 2000). At the same time, during adolescence, parent ratings of personality may diverge more from the self-reports of their adolescent children because it is a time for children to become more independent from parents (Smetana, 2015) and to focus more on peer relationships (Arnett, 2000). Accordingly, research has illustrated both significant agreement and substantial disagreement when comparing adolescents' self-reports and parent ratings of personality (Göllner et al., 2017; Luan et al., 2017; Rohrer et al., 2018; Vazire & Mehl, 2008).

The *self-other knowledge asymmetry* (SOKA; Vazire, 2010) model can help explain potential reasons for such (dis)agreement in different phases of the rater process. The SOKA model focuses on explaining when self- versus other-ratings should be more (or less) accurate. It postulates that the agreement between self- and other-ratings differs on the basis of (a combination of) the observability and evaluativeness of each trait. For instance, agreement is higher for traits that are easy to observe but are low on evaluativeness (e.g., extraversion). Disagreement will be higher, however, when observability is low (e.g., for emotional stability), with more accurate self- than other ratings.

For adult samples, empirical research has largely supported the SOKA model (Connolly et al., 2007; Connelly & Ones, 2010). By contrast, only a few studies have investigated self-other agreement across adolescence. Specifically, a study of Estonian ninth-grade adolescents (between 14 and 17 years of age) and their mothers and fathers found only low to moderate interrater agreement for all traits (Laidra et al., 2006), whereas two recent studies found evidence for the SOKA model: Adolescent-parent agreement was higher for extraversion as an observable but not an evaluative trait in comparison with emotional stability, which is less observable, and agreeableness, which is highly evaluative (Göllner et al., 2017, Luan et al., 2017). In summary, although parents should know their children relatively well, self-other

agreement between parents and adolescents has been found to be generally lower than between two young adults; yet, agreement between parents and adolescents appears to increase from age 14 to 29 (Rohrer et al., 2018).

Taken together, each perspective, self and other, can potentially contribute to the understanding of associations between personality and psychosocial functioning, depending on age and trait characteristics. However, to date, little is known about the comparability of self- and other personality ratings in adolescence as personality association studies have typically relied on single reporter data, whereas multi-informant studies are rare. Thus, to get a more comprehensive understanding of similarities and differences between the two rater perspectives and the effects on investigated associations, we aimed at a systematical statistical comparison across a broad range of associations between personality and psychosocial functioning variables.

### **The Present Study**

Building on conceptual and empirical notions of the adaptive capacity of personality across the adult lifespan (Caspi et al., 2005; Ozer & Benet-Martínez, 2006; Roberts et al., 2007, Soto, 2019), we aimed to test whether personality is also associated with different indicators of psychosocial functioning in adolescence. Thereby, we focused on developmental tasks during adolescence, which are usually embedded in one of the most prevalent ecosystems of adolescence: the school context (Bronfenbrenner, 1979; Eccles & Roeser, 2011). The aim of the current study was then twofold: First, we examined the differential role of personality while investigating associations with three domains of psychosocial functioning: achievement, social relationships, and psychosocial adjustment. Thereby, we differentiated between four achievement variables (school grades and test scores in the domains of German and mathematics), three social relationship variables (peer-rated helpfulness, peer-rated aggressiveness, and teacher-student relationship quality), and three psychosocial adjustment indicators (self-esteem, well-being in school, and parent-rated somatoform health problems). Besides including a broad range of indicators, multiple informants, and highly underrepresented age groups, this study extends the existing literature by also investigating a diverse sample in terms of its heterogeneous academic and personal background.

In replicating previous cross-sectional findings, we hypothesized that being highly conscientious will be related to better school grades (H1a), whereas high openness will be associated with better achievement test scores (H1b). Due to mixed findings regarding the other three traits, we refrain from formulating concrete hypotheses. In the domain of social

relationships, we hypothesized that higher levels of agreeableness and conscientiousness will be associated with peer perceptions of more helpfulness (H2a). Furthermore, higher levels of emotional stability, agreeableness, and conscientiousness will be related to peer perceptions of lower aggressiveness (H2b), and to more positive teacher-student relationships (H2c; Harris & Vazire, 2016; Jensen-Campbell et al., 2003). Due to mixed findings regarding extraversion and openness, we refrain from formulating hypotheses. Finally, for psychosocial adjustment, we hypothesized that being higher on emotional stability and extraversion would be related to higher self-esteem (H3a). Higher levels of emotional stability, extraversion, and conscientiousness will be related to greater overall well-being in school (H3b). Higher levels of emotional stability and conscientiousness will be associated with fewer parent-rated health problems (H3c; Butkovic et al., 2012).

Second, we set out to disentangle these general associations and to take into account the specific time interval of adolescence as a highly disruptive phase. Thus, we compared the associations between personality and three domains of psychosocial functioning across three adolescent cohorts and considered different rater perspectives. Yet, given the scarce previous research, we tested for differences in associations between Grades 5, 7, and 9 in an exploratory fashion. We also examined differential associations of self- and parent ratings of adolescents' personality with psychosocial functioning. By doing so, we were able to systematically investigate the robustness of personality-psychosocial functioning associations across different rater perspectives. Referring to the SOKA model (Vazire, 2010), we hypothesized to find more agreement between self- and parent ratings for extraversion (H4a) and lower agreement for emotional stability (H4b), whereas higher agreement should go along with more similar associations with psychosocial functioning. Given that evidence for personality associations from different perspectives in adolescence is still scarce, we considered the remaining tests exploratory, and we conducted them to stimulate future research.

### **Method**

We analyzed the first wave of data from a German multicohort study "Entwicklung und Implementierung eines neuen Konzeptes zur Eingliederung Jugendlicher in die Berufs- und Arbeitswelt in Schulen mit erhöhtem Förderbedarf" (EIKA, 2006) [Development and Implementation of a School-to-Work Transition Concept for Schools Serving Disadvantaged Communities]. The project, based in Bremen (Germany), was initiated to investigate antecedents of academic achievement and adjustment with a focus on students' ethnic and

socioeconomic differences. We did not preregister our hypotheses on the Open Science Framework (OSF). However, we report how we determined our sample size, all data exclusions, and all measures in the study, or we refer to detailed documentations in the OSF ([https://osf.io/pjdcs/?view\\_only=c5dd0469da8c43328b4d68242a920dd7](https://osf.io/pjdcs/?view_only=c5dd0469da8c43328b4d68242a920dd7)). All analyses including the exact *p*-values and 95% confidence intervals can also be found on the OSF. Due to the high complexity of the tables, the large number of models, and therefore greater clarity, we do not report confidence intervals in the tables. Exact *p*-values for each effect of interest, however, can be found in the Tables OS 12-20. The final data set provided by Olaf Köller was also uploaded to the OSF.

### **Participants**

At the beginning of the study in 2004, students attended Grade 5, 7, or 9 in different types of secondary schools. A total of 36% of the participating schools were academic-track schools, which prepare students for university education, whereas the other 64% were vocational-track schools, which provide vocational education. All schools served disadvantaged communities (i.e., the sample included comparably high percentages of families with low socioeconomic status and an immigration status). Thus, the sample could be considered quite a diverse sample of adolescents and their parents, especially with respect to their immigration status. Specifically, about 55% of the parents' generation had a migrant background and were mainly born in countries of the former Soviet Union or in Turkey. Of the participating students, about 14% were born abroad and roughly 40% had an immigration status. Importantly, students with an immigration status came from socially and culturally disadvantaged families compared to students without an immigration status (EIKA, 2005). They also had poorer knowledge of German (the national language) and showed lower academic achievement. For more details about the sample composition, please see EIKA (2005; 2006). From the original sample ( $N = 3,569$ ), we included all students who gave at least one valid answer for one personality item from either a self- or parent rating. The final cross-sectional sample consisted of 2,667 students from 157 classes. During data collection, students were approximately 11, 13, and 15 years old in Grade 5 ( $n = 738$ ), 7 ( $n = 986$ ), or 9 ( $n = 943$ ), respectively, with an equal distribution of girls and boys (50% female students). Approximately 40% of all students were first- or second-generation immigrants. For 305 students, only parent ratings of personality were available. The final cross-sectional data set included 1,959 parent ratings. The majority of the parent questionnaires were completed by the mother (51%) versus the father (10%). In approximately 37% of the cases, parents filled out the questionnaire

together, and 2% of the ratings came from another person who was responsible for the adolescent.

No personality data existed for 25% ( $n = 902$ ) of the original sample. Selectivity analyses between the participants with and without personality data indicated that the excluded students had a lower IQ (Cohen's  $d = -0.25$ ), lower socioeconomic status ( $d = -0.55$ ), and were more likely to have an immigration status ( $d = 0.20$ ). Moreover, they differed on all achievement indicators from  $d = -0.23$  for mathematics school grades to  $d = -0.36$  for reading competence and were rated as less helpful ( $d = -0.14$ ) and more aggressive ( $d = 0.20$ ) by their classmates. Furthermore, the excluded students reported lower self-esteem ( $d = -0.31$ ). The groups did not differ with respect to gender, the quality of the relationship with their teacher, well-being in school, and parent-rated health problems. The existing differences between the two groups indicated a small to medium degree of selectivity that should be considered when interpreting the results.

## Measures

### *Personality*

For both the adolescent self- and parent ratings, Big Five personality was assessed with the identical 40-item Ostendorf scale (Ostendorf, 1990), a well-established personality instrument (for details, see Asendorpf & van Aken, 2003). Each personality trait was assessed with eight pairs of adjectives on a 5-point Likert scale (e.g., extraversion: “quiet – talkative”), with three to five negatively worded items that were reverse-scored for all further analyses. Following recent recommendations (Revelle & Condon, 2019), reliability was estimated using McDonald's  $\omega$  (McDonald, 1999) and was satisfactory for the five personality scales rated by adolescents in Grades 5/7/9, respectively: .65/.75/.77 for emotional stability, .75/.79/.85 for extraversion, .72/.76/.78 for openness, .74/.78/.76 for agreeableness, and .79/.80/.83 for conscientiousness. McDonald's  $\omega$  for parent-rated personality was good: .85/.84/.86 for emotional stability, .90/.88/.90 for extraversion, .87/.85/.86 for openness, .84/.83/.85 for agreeableness, and .90/.89/.90 for conscientiousness.

### *Academic Achievement*

We used four different indicators of academic achievement: self-reported German and mathematics school grades from the last end-of-year school report and standardized achievement tests for reading and mathematics. School grades were coded so that higher values reflected higher achievement, with grades ranging from 1 (*insufficient*) to 6 (*very good*). Self-

reported grades can be considered reliable and valid indicators of achievement (Dickhäuser & Plenter, 2005; Sanchez & Buddin, 2015). The achievement tests for reading and mathematics were developed from a selection of established items from large national and international school achievement studies such as LAU (“Lernausgangslagenuntersuchung“ – Learning baseline study; Lehmann & Peek, 1997), PIRLS (“Progress in International Reading Literacy Study; Ogle et al., 2003), TIMSS (“Trends in International Mathematics and Science Study”; Baumert et al., 1997; Baumert et al., 2000), and PISA (Programme for International Student Assessment; OECD, 2004). Only released items were taken from international studies. All items were designed as multiple-choice questions. Students were to select the one correct answer from either four or five possible solutions. Total sum scores were provided for each student. Reliabilities for the mathematics and reading achievement test were satisfactory (Cronbach’s  $\alpha > .80$  in all grades; Köller, 2005).

### ***Social Relationships***

We analyzed three different variables as social relationship indicators: helpfulness, aggression, and teacher-student relationship quality. The helpfulness and aggression indicators for each student represent an accumulated peer-reported mean. Specifically, both helpfulness and aggression were assessed with a single item that was rated and provided by all classmates (“This student helps me” and “This student is aggressive toward classmates,” respectively). These single-item ratings were then averaged across all classmates and thus present target effects of other-rated perceived helpfulness and aggression in school (Nestler et al., 2015). The average class size of the participating schools ranged from 20 to 25 students (Köller, 2005). As a third indicator, students rated their relationship with their teacher via five items (Kunter et al., 2002) on a 4-point Likert scale (e.g., “My teacher’s treatment of me is fair”). Cronbach’s alpha was satisfactory ( $\alpha = .75$ ).

### ***Psychosocial Adjustment***

We used three different adjustment indicators: self-esteem, well-being in school, and health problems. Self-rated self-esteem was measured via the 10-item Rosenberg scale (e.g., “On the whole, I am satisfied with myself”) where each item has to be rated on a 4-point Likert scale (Rosenberg, 1965). To assess well-being in school, students were asked to answer five items (adopted from PISA 2003, see Ramm et al., 2006) on a 4-point Likert scale (e.g., “My school is a place where I feel lonely”; reverse-coded). For the analysis of health problems, we used parents’ reports of the health problem Achenbach scale (Achenbach, 1991) where parents



are asked about their children's physical problems (e.g., nausea) for which there are no known physical reasons. They had to fill out a 10-item questionnaire rating each item on a 3-point Likert scale. The internal consistency of all three adjustment indicators showed satisfactory values (self-esteem:  $\alpha = .80$ ; well-being in school:  $\alpha = .71$ ; health problems:  $\alpha = .69$ ).

### ***Control Variables***

We included three dummy-coded and one continuous control variable in our models: gender, socioeconomic status (SES), immigration status, and intelligence, respectively. At the beginning of the assessment, participants reported their gender (0 = male vs. 1 = female) and their immigration status (0 = no vs. 1 = yes). SES was measured by asking adolescents how many books they have at home, whereby we used a dummy-coded variable where 0 referred to "50 or fewer than 50 books" and 1 referred to "more than 50 books." Research indicates good applicability of this question for measuring SES (e.g., Bos, 2003; Wendt et al., 2016). Intelligence was tested with a subset of questions from Cattell's Culture Fair Intelligence Test (CFT 20; Weiß, 1998) and was then *z*-standardized. All items were designed as language-free multiple-choice questions where adolescents had to select one correct answer from five possible solutions.

Tables OS1 and OS2 in the online supplement provide descriptive statistics for all variables for the total sample and for the separate grades along with the intercorrelations of all variables.

### ***Analysis Strategy***

Our analytic strategy followed two main steps: After data preparation, we first tested for measurement invariance (MI; Little, 2013) in the personality variables. Second, we conducted latent regression analyses and also statistically tested the differences between grades and raters.

### ***Data Preparation***

Answering our research questions involved two steps of data preparation. First, to model the latent personality factors, we used a set of three indicator parcels for self-rated personality (Little, 2013): two composed of three items, and one composed of two items. Items were distributed according to their item-to-construct loadings (Little et al., 2002); that is, the items with the highest loadings set the anchor for the three parcels. Items with lower loadings were then matched with higher loading parcels to construct balanced parcels with respect to

their difficulty and discrimination (intercept and slope). The same parcels were then applied to the parent ratings.

Second, to make full use of the data and handle the large number of missing values in some variables (see Table OS1), especially in fifth grade, we implemented a multiple imputation approach using the statistical software R and the packages *mice* (van Buuren & Groothuis-Oudshoorn, 2011) and *miceadds* (Robitzsch et al., 2019). The percentages of missing data in the personality and psychosocial functioning variables varied from approximately 1% (reading competence) to 79% (school grades) in fifth, from almost 0% (helpfulness and aggressiveness) to 34% (emotional stability and openness rated by parents) in seventh, and from 0% (helpfulness and aggressiveness) to 30% (conscientiousness rated by parents) in ninth grade. The percentage of missing data in the covariates varied from 0% (gender) to 22% (socioeconomic status). In keeping with the nested and multigroup structure of the data, we carried out the imputations separately for each grade (Enders & Gottschall, 2011) and used imputation methods suitable for multilevel data (Lüdtke et al., 2017). Specifically, we used imputation methods based on linear mixed-effects models (“2l.continuous” method) to impute missing values in continuous data (reading and math achievement test scores, IQ) and linear mixed-effects models followed by predictive mean matching (“2l.pmm” method) for binary and ordinal data (all other variables). The imputation was carried out at the item level to make full use of the available data (Gottschall et al., 2012). In line with recent recommendations, we generated 50 imputations (Graham et al., 2007). However, even with the imputed data, we found that the uncertainty in German and mathematics school grades in fifth grade was too high to draw meaningful conclusions as indicated by a very high fraction of missing information (FMI) in the respective models. Therefore, we do not report any associations with school grades in the fifth grade.

All the following models were estimated using Mplus Version 8 (Muthén & Muthén, 2017). We evaluated the fit of all models using well-established model fit criteria, such as the comparative fit index (CFI), the root mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR). We considered the fit acceptable or excellent, respectively, when the CFI was greater than .90 or .95, the RMSEA was below .08 or .05, and the SRMR was below .10 or .05 (Hu & Bentler, 1998; Marsh et al., 2005; Schermelleh-Engel et al., 2003). Furthermore, to account for the hierarchical data structure (students clustered in classes), we used the `type = COMPLEX` option in Mplus to adjust the standard errors in all models.

***Measurement Invariance Testing Across Grades and Between Raters***

As a first step in the analysis, we aimed to implement at least weak measurement invariance (MI) of personality across grades (Grades 5/7/9) and between raters (adolescents and their parents) to be able to compare associations of personality traits with the psychosocial functioning variables, that is, the item loadings had to be at least equal across groups and raters. We tested for three types of MI (Little, 2013). First, we conducted multigroup confirmatory factor analyses by using “grade” as the grouping variable and estimating the models based on the self-reported personality items. In doing so, we contrasted the measurement properties of self-reported personality across fifth-, seventh-, and ninth-graders. The second type followed the same logic, but instead of students’ personality ratings, we estimated the models by using parents’ personality ratings. In the third type, we aimed to implement MI across both raters. These models included personality ratings by students and parents to guarantee that observed differences between raters were not due to the measurement properties of the indicators. These models did not distinguish between grades. For this third type of MI testing, we allowed latent personality traits to correlate between raters because self- and parent ratings are dependent ratings.

All three types of MI were tested in three steps (see Table 1) and by estimating each trait separately. We estimated increasingly restrictive measurement models and evaluated both their overall model fit and changes in the model fit criteria. Using the comparison criteria according to Chen (2007), model fit in the more restrictive model should not exceed a change of .010 in the CFI, .015 in the RMSEA, and .030 in the SRMR.<sup>1</sup> Table 1 summarizes the results. Stepwise comparisons illustrated that in some cases, the implementation of strong measurement invariance was associated with model fit changes that exceeded the criteria. At the same time, even these most restrictive models still had good overall model fit, that is, loadings and intercepts were set equal across grades within self-ratings (first model set), within parent ratings (second model set), and overall between raters (third model set). Accordingly, we decided to select the strong invariance models as the baseline models with respect to all traits and all raters for the following analyses. The results are in line with the notion of comparable measurement properties of the Big Five personality traits across different grades (already in fifth grade or from age 11) for self- and parent ratings of personality as well as between self- and parent ratings.

**Table 1**

Fit Indices for Measurement Invariance Tests of Personality Across Grades (5, 7, and 9) and Self- and Parent Ratings with Item Parcels

| Model                      | Model set 1                          |           |     |       |      | Model set 2                            |           |     |       |      | Model set 3                        |           |      |       |      |      |
|----------------------------|--------------------------------------|-----------|-----|-------|------|--|-----------|-----|-------|------|------------------------------------|-----------|------|-------|------|------|
|                            | MI across grades within self-ratings |           |     |       |      | MI across grades within parent ratings |           |     |       |      | MI across self- and parent ratings |           |      |       |      |      |
|                            | $\chi^2$                             | <i>df</i> | CFI | RMSEA | SRMR | $\chi^2$                               | <i>df</i> | CFI | RMSEA | SRMR | $\chi^2$                           | <i>df</i> | CFI  | RMSEA | SRMR |      |
| <b>Emotional stability</b> | Configural invariance                |           |     |       |      |  |           |     |       |      | 31.106**                           | 8         | .991 | .032  | .016 |      |
|                            | Weak invariance                      | 6.700     | 4   | .997  | .024 | .031                                   | 2.928     | 4   | 1.000 | .004 | .021                               | 36.553**  | 10   | .989  | .031 | .022 |
|                            | Strong invariance                    | 18.089*   | 8   | .989  | .036 | .032                                   | 6.669     | 8   | .999  | .005 | .025                               | 167.422** | 12   | .938  | .070 | .051 |
| <b>Extraversion</b>        | Configural invariance                |           |     |       |      |  |           |     |       |      |                                    | 40.238**  | 8    | .991  | .038 | .019 |
|                            | Weak invariance                      | 7.618     | 4   | .997  | .029 | .029                                   | 12.912*   | 4   | .996  | .048 | .044                               | 47.673**  | 10   | .990  | .037 | .029 |
|                            | Strong invariance                    | 39.911**  | 8   | .977  | .066 | .025                                   | 26.094**  | 8   | .991  | .049 | .046                               | 78.846**  | 12   | .982  | .045 | .026 |
| <b>Openness</b>            | Configural invariance                |           |     |       |      |  |           |     |       |      |                                    | 62.942**  | 8    | .980  | .050 | .022 |
|                            | Weak invariance                      | 3.831     | 4   | .999  | .009 | .023                                   | 5.296     | 4   | .999  | .016 | .032                               | 71.056**  | 10   | .978  | .047 | .029 |
|                            | Strong invariance                    | 44.721**  | 8   | .957  | .071 | .046                                   | 14.057    | 8   | .997  | .027 | .044                               | 96.507**  | 12   | .969  | .051 | .030 |
| <b>Agreeableness</b>       | Configural invariance                |           |     |       |      |  |           |     |       |      |                                    | 34.312**  | 8    | .988  | .035 | .019 |
|                            | Weak invariance                      | 8.068     | 4   | .995  | .030 | .031                                   | 3.272     | 4   | 1.000 | .006 | .022                               | 45.513**  | 10   | .984  | .036 | .032 |
|                            | Strong invariance                    | 30.765**  | 8   | .972  | .055 | .026                                   | 23.236**  | 8   | .986  | .045 | .026                               | 85.978**  | 12   | .967  | .048 | .046 |
| <b>Conscientiousness</b>   | Configural invariance                |           |     |       |      |  |           |     |       |      |                                    | 45.733**  | 8    | .990  | .041 | .015 |
|                            | Weak invariance                      | 14.267**  | 4   | .991  | .051 | .046                                   | 3.513     | 4   | 1.000 | .007 | .020                               | 69.678**  | 10   | .985  | .047 | .037 |
|                            | Strong invariance                    | 23.163**  | 8   | .986  | .045 | .042                                   | 18.538*   | 8   | .995  | .037 | .022                               | 181.325** | 12   | .957  | .073 | .033 |

Note. CFI: comparative fit index; RMSEA: root mean square error of approximation; SRMR: standardized root mean square residual.

\*  $p < .05$ . \*\*  $p < .01$ .

### ***Associations Between Personality and Psychosocial Functioning***

To analyze the associations between personality and psychosocial functioning, we conducted latent regression analyses based on the first and second multigroup CFA model of our measurement invariance analysis, that is, measurement models with comparable loadings, and intercepts across grades for both self- and parent ratings. For associations with psychosocial functioning, we estimated models with “grade” as the grouping factor and separately for the self- and parent ratings. The latent regression analyses were conducted separately for each personality trait, for both raters, and for each psychosocial functioning variable, resulting in 5 (Big Five traits) x 2 (raters) x 10 (psychosocial functioning variables) = 100 different models. The effect of interest was the regression effect of personality from each perspective on each psychosocial functioning variable in each grade. To take the great number of tests into account, but also to account for the typically small effect sizes in personality psychology (Funder & Ozer, 2019), we report only associations that were statistically significant at  $p < .01$ . In all regression analyses, we furthermore controlled for gender, IQ, socioeconomic status, and immigration status. These variables are considered confounders of the investigated associations as they impact both personality and the variables related to developmental tasks.

We tested whether grade-specific effects were statistically significantly different by using pairwise comparisons and the multiparameter Wald test (Grund et al., 2016). The Wald test was used to evaluate the omnibus hypothesis according to which the effects of personality would be equal across grades, whereas the rejection of the hypothesis would indicate that they differed in a statistically significant way. Pairwise comparisons were then used to investigate specific differences between grades.

The two perspectives of self- and parent-rated personality share a substantial amount of variance (see Table OS2). As we were not interested in the associations with the unique personality part of each rater perspective, but we wanted to include all of the rater variance, we conducted separate analyses for students and parents. To take into account the dependencies of the parameter estimates when assessing whether the associations differed between rater perspectives (i.e., both models were based on the same sample and variables, with the exception of the personality ratings), we implemented a bootstrapping procedure. More specifically, we generated 100 bootstrapped samples for each imputed data set, resulting in a total of 50 (imputations) x 100 (samples) = 5,000 bootstrapped samples. The models were then refit with all bootstrapped samples to obtain an estimate of the standard error of the difference between

rater perspectives for each association and each imputation. Finally, we pooled the results across imputations using Rubin's (1987) rules (for additional details on this procedure, see Schomaker & Heumann, 2018). Thus, this analytic strategy was applied to investigate whether the associations between personality and psychosocial functioning were robust across the different rater perspectives.

As 40% of our participants had an immigration status, we ran additional analyses that included interaction effects between latent self-rated personality and manifest immigration status on all outcomes. With these analyses, we tested the robustness of effects.

## **Results**

In the following paragraphs, we summarize the associations of personality with the three domains of psychosocial functioning: achievement, social relationships, and psychosocial adjustment. We first report the overall pattern for the Big Five-psychosocial functioning associations. Then, we report grade- and rater-sensitive associations and highlight the statistically significant results. We describe our findings in terms of consistent and congruent effects: Consistent effects illustrate that effects show a similar pattern of significance across grades. Congruent effects illustrate a similar pattern of significance across raters.

To test the interrelatedness of personality with the three domains of psychosocial functioning, we established latent regression models for each combination of trait, psychosocial functioning variable, and rater perspective, separately. Tables 2, 3, and 4 show all associations of personality with psychosocial functioning separated by the achievement, social relationship, and psychosocial adjustment domain. Moreover, each table contains the effects differentiated for the three grades, separated across the models of self- and parent ratings. In all reported models, the fit indices illustrated a good model fit. Please note that personality-grade models are based on only two cohorts (Grades 7 and 9), whereas the models for personality and the remaining psychosocial functioning variables include all three cohorts (see the Method section). Tables OS 5 to 7 present the standardized effects of the covariates. Additionally, to provide an overview of the large number of findings, Table OS 8 summarizes our hypotheses and the main results of the study.

Table 2

Standardized Regression Effects of Self- and Parent-Reported Personality on the Four Achievement Outcome Variables in Grades 5, 7, and 9

|                            |         | German school grade        |      |             |      | Mathematics school grade   |      |             |      | Reading competence   |      |             |      | Mathematics competence |      |         |      |
|----------------------------|---------|----------------------------|------|-------------|------|----------------------------|------|-------------|------|----------------------|------|-------------|------|------------------------|------|---------|------|
|                            |         | Adolescents                |      | Parents     |      | Adolescents                |      | Parents     |      | Adolescents          |      | Parents     |      | Adolescents            |      | Parents |      |
|                            |         | $\beta$                    | SE   | $\beta$     | SE   | $\beta$                    | SE   | $\beta$     | SE   | $\beta$              | SE   | $\beta$     | SE   | $\beta$                | SE   | $\beta$ | SE   |
| <b>Emotional stability</b> | Grade 5 | /                          | /    | /           | /    | /                          | /    | /           | /    | 0.27*** <sub>a</sub> | 0.06 | 0.12**      | 0.04 | 0.23***                | 0.05 | 0.11**  | 0.04 |
|                            | Grade 7 | 0.23***                    | 0.04 | 0.15**      | 0.05 | 0.16***                    | 0.04 | 0.13**      | 0.04 | <b>0.23***</b>       | 0.04 | <b>0.08</b> | 0.04 | 0.18***                | 0.03 | 0.11**  | 0.04 |
|                            | Grade 9 | 0.09                       | 0.05 | 0.07        | 0.04 | 0.01                       | 0.05 | 0.04        | 0.04 | 0.12** <sub>b</sub>  | 0.04 | 0.10**      | 0.04 | 0.12**                 | 0.04 | 0.06    | 0.03 |
| <b>Extraversion</b>        | Grade 5 | /                          | /    | /           | /    | /                          | /    | /           | /    | 0.20*** <sub>a</sub> | 0.05 | 0.07        | 0.03 | 0.13**                 | 0.05 | 0.05    | 0.03 |
|                            | Grade 7 | <b>0.22***<sub>a</sub></b> | 0.04 | <b>0.04</b> | 0.05 | <b>0.16***<sub>a</sub></b> | 0.04 | <b>0.02</b> | 0.04 | 0.19*** <sub>a</sub> | 0.04 | 0.07        | 0.04 | 0.14*** <sub>a</sub>   | 0.03 | 0.08    | 0.03 |
|                            | Grade 9 | 0.01 <sub>b</sub>          | 0.05 | -0.03       | 0.03 | -0.08 <sub>b</sub>         | 0.04 | -0.07       | 0.04 | 0.02 <sub>b</sub>    | 0.04 | 0.02        | 0.04 | 0.01 <sub>b</sub>      | 0.03 | 0.01    | 0.03 |
| <b>Openness</b>            | Grade 5 | /                          | /    | /           | /    | /                          | /    | /           | /    | 0.30***              | 0.06 | 0.30***     | 0.05 | 0.25*** <sub>a</sub>   | 0.06 | 0.21*** | 0.05 |
|                            | Grade 7 | 0.30***                    | 0.04 | 0.22***     | 0.05 | 0.23***                    | 0.04 | 0.16**      | 0.05 | 0.29***              | 0.04 | 0.23***     | 0.05 | 0.22*** <sub>a</sub>   | 0.04 | 0.14*** | 0.04 |
|                            | Grade 9 | 0.19**                     | 0.06 | 0.13        | 0.05 | 0.10                       | 0.05 | 0.04        | 0.05 | 0.15***              | 0.04 | 0.17***     | 0.04 | 0.08 <sub>b</sub>      | 0.04 | 0.12**  | 0.04 |
| <b>Agreeableness</b>       | Grade 5 | /                          | /    | /           | /    | /                          | /    | /           | /    | 0.17**               | 0.05 | 0.11        | 0.04 | 0.10                   | 0.06 | 0.04    | 0.04 |
|                            | Grade 7 | 0.18***                    | 0.05 | 0.10        | 0.05 | 0.14***                    | 0.04 | 0.05        | 0.04 | 0.13**               | 0.05 | 0.03        | 0.04 | 0.08                   | 0.03 | 0.00    | 0.03 |
|                            | Grade 9 | 0.05                       | 0.05 | -0.01       | 0.05 | 0.02                       | 0.04 | 0.01        | 0.04 | 0.04                 | 0.04 | -0.02       | 0.04 | 0.06                   | 0.04 | 0.00    | 0.03 |
| <b>Conscientiousness</b>   | Grade 5 | /                          | /    | /           | /    | /                          | /    | /           | /    | 0.13**               | 0.05 | 0.05        | 0.04 | 0.12**                 | 0.04 | 0.03    | 0.04 |
|                            | Grade 7 | 0.23***                    | 0.04 | 0.24***     | 0.04 | 0.17***                    | 0.04 | 0.18***     | 0.05 | 0.10***              | 0.03 | 0.06        | 0.04 | 0.10**                 | 0.03 | 0.06    | 0.03 |
|                            | Grade 9 | 0.15**                     | 0.05 | 0.17***     | 0.05 | 0.14***                    | 0.04 | 0.15***     | 0.04 | 0.05                 | 0.03 | 0.01        | 0.04 | 0.07                   | 0.03 | 0.08    | 0.03 |
| <b>Model fit range</b>     | CFI     | .95-.97                    |      | .95-.98     |      | .95-.98                    |      | .95-.98     |      | .96-.98              |      | .95-.99     |      | .97-.98                |      | .96-.99 |      |
|                            | RMSEA   | .04-.05                    |      | .03-.07     |      | .04-.05                    |      | .03-.07     |      | .04-.06              |      | .03-.07     |      | .04-.05                |      | .03-.08 |      |
|                            | SRMR    | .02-.03                    |      | .02-.03     |      | .02-.03                    |      | .02-.03     |      | .03                  |      | .02-.03     |      | .03                    |      | .02-.03 |      |

Note. / = Not included in the analysis because of high proportions of missing data. All effects were controlled for gender, IQ, socioeconomic status, and immigration status. Indices a and b indicate that regression weights differ between grades at  $p < .01$ . Bold values show significant differences in regression weights between raters at  $p < .01$ .  $N = 2,667$ .

\*\*  $p < .01$ . \*\*\*  $p < .001$ .

Table 3

Standardized Regression Effects of Self- and Parent-Reported Personality on the Three Social Relationship Variables in Grades 5, 7, and 9

|                            |         | Helpfulness |      |         |      | Aggressiveness |      |          |      | Teacher-student relationship |      |             |      |
|----------------------------|---------|-------------|------|---------|------|----------------|------|----------|------|------------------------------|------|-------------|------|
|                            |         | Adolescents |      | Parents |      | Adolescents    |      | Parents  |      | Adolescents                  |      | Parents     |      |
|                            |         | $\beta$     | SE   | $\beta$ | SE   | $\beta$        | SE   | $\beta$  | SE   | $\beta$                      | SE   | $\beta$     | SE   |
| <b>Emotional stability</b> | Grade 5 | 0.22***     | 0.06 | 0.14*** | 0.04 | -0.12          | 0.05 | -0.02    | 0.04 | 0.22**                       | 0.07 | 0.10        | 0.05 |
|                            | Grade 7 | 0.11**      | 0.04 | 0.16*** | 0.04 | -0.05          | 0.04 | -0.06    | 0.05 | 0.19*** <sub>a</sub>         | 0.04 | 0.10        | 0.04 |
|                            | Grade 9 | 0.10        | 0.05 | 0.17*** | 0.04 | -0.06          | 0.04 | -0.06    | 0.04 | 0.02 <sub>b</sub>            | 0.04 | 0.03        | 0.05 |
| <b>Extraversion</b>        | Grade 5 | 0.16        | 0.06 | 0.03    | 0.05 | -0.02          | 0.05 | 0.02     | 0.04 | <b>0.24***<sub>a</sub></b>   | 0.06 | <b>0.04</b> | 0.04 |
|                            | Grade 7 | 0.16***     | 0.04 | 0.14**  | 0.04 | -0.05          | 0.04 | 0.06     | 0.04 | 0.18*** <sub>a</sub>         | 0.04 | 0.12**      | 0.05 |
|                            | Grade 9 | 0.07        | 0.04 | 0.11**  | 0.03 | 0.05           | 0.03 | 0.10     | 0.04 | 0.02 <sub>b</sub>            | 0.04 | 0.01        | 0.05 |
| <b>Openness</b>            | Grade 5 | 0.18**      | 0.07 | 0.12**  | 0.05 | -0.08          | 0.06 | -0.08    | 0.04 | 0.29***                      | 0.08 | 0.14        | 0.06 |
|                            | Grade 7 | 0.14**      | 0.05 | 0.10    | 0.05 | -0.09          | 0.05 | 0.00     | 0.05 | 0.15**                       | 0.05 | 0.13        | 0.05 |
|                            | Grade 9 | 0.14**      | 0.04 | 0.11    | 0.05 | -0.11**        | 0.04 | -0.00    | 0.04 | 0.08                         | 0.05 | 0.05        | 0.05 |
| <b>Agreeableness</b>       | Grade 5 | 0.23***     | 0.05 | 0.13**  | 0.05 | -0.17***       | 0.05 | -0.20*** | 0.04 | 0.25***                      | 0.07 | 0.07        | 0.05 |
|                            | Grade 7 | 0.18**      | 0.05 | 0.09    | 0.05 | -0.17***       | 0.05 | -0.16*** | 0.04 | 0.24***                      | 0.05 | 0.17**      | 0.05 |
|                            | Grade 9 | 0.12        | 0.05 | 0.15*** | 0.04 | -0.22***       | 0.04 | -0.14**  | 0.04 | 0.19***                      | 0.05 | 0.12        | 0.05 |
| <b>Conscientiousness</b>   | Grade 5 | 0.14        | 0.06 | 0.20*** | 0.05 | -0.13          | 0.05 | -0.16*** | 0.04 | 0.20**                       | 0.06 | 0.12        | 0.05 |
|                            | Grade 7 | 0.14**      | 0.05 | 0.09    | 0.05 | -0.11**        | 0.04 | -0.17*** | 0.04 | 0.14**                       | 0.04 | 0.18***     | 0.04 |
|                            | Grade 9 | 0.17***     | 0.04 | 0.16**  | 0.05 | -0.11**        | 0.04 | -0.11**  | 0.04 | 0.12**                       | 0.05 | 0.15**      | 0.05 |
| <b>Model fit range</b>     | CFI     | .93-.96     |      | .94-.98 |      | .95-.98        |      | .95-.98  |      | .93-.97                      |      | .95-.98     |      |
|                            | RMSEA   | .04-.05     |      | .03-.07 |      | .04-.05        |      | .04-.07  |      | .04-.05                      |      | .03-.07     |      |
|                            | SRMR    | .02-.03     |      | .02-.03 |      | .02-.03        |      | .02-.03  |      | .02-.03                      |      | .02-.03     |      |

Note. All effects were controlled for gender, IQ, socioeconomic status, and immigration status. Indices a and b indicate that regression weights differ between grades at  $p < .01$ . Bold values show significant differences in regression weights between raters at  $p < .01$ .  $N = 2,667$ .

\*\*  $p < .01$ . \*\*\*  $p < .001$ .



Table 4

Standardized Regression Effects of Self- and Parent-Reported Personality on the Three Psychosocial Adjustment Variables in Grades 5, 7, and 9

|                            |         | Self-esteem                |      |                |      | Well-being in school |      |                |      | Health problems |      |                       |      |
|----------------------------|---------|----------------------------|------|----------------|------|----------------------|------|----------------|------|-----------------|------|-----------------------|------|
|                            |         | Adolescents                |      | Parents        |      | Adolescents          |      | Parents        |      | Adolescents     |      | Parents               |      |
|                            |         | $\beta$                    | SE   | $\beta$        | SE   | $\beta$              | SE   | $\beta$        | SE   | $\beta$         | SE   | $\beta$               | SE   |
| <b>Emotional stability</b> | Grade 5 | <b>0.51***</b>             | 0.06 | <b>0.10</b>    | 0.07 | <b>0.35***</b>       | 0.07 | <b>0.16**</b>  | 0.05 | -0.05           | 0.07 | -0.18*** <sub>a</sub> | 0.04 |
|                            | Grade 7 | <b>0.53***</b>             | 0.04 | <b>0.22***</b> | 0.05 | 0.33***              | 0.04 | 0.24***        | 0.05 | -0.19***        | 0.05 | -0.32*** <sub>b</sub> | 0.04 |
|                            | Grade 9 | <b>0.47***</b>             | 0.04 | <b>0.21***</b> | 0.05 | 0.28***              | 0.04 | 0.14**         | 0.05 | -0.11           | 0.06 | -0.18***              | 0.04 |
| <b>Extraversion</b>        | Grade 5 | <b>0.42***<sub>a</sub></b> | 0.06 | <b>0.08</b>    | 0.06 | <b>0.29***</b>       | 0.06 | <b>0.12</b>    | 0.05 | -0.05           | 0.06 | -0.09 <sub>a</sub>    | 0.04 |
|                            | Grade 7 | <b>0.41***<sub>a</sub></b> | 0.03 | <b>0.15**</b>  | 0.05 | <b>0.39***</b>       | 0.04 | <b>0.17***</b> | 0.05 | -0.10           | 0.05 | -0.22*** <sub>b</sub> | 0.04 |
|                            | Grade 9 | <b>0.30***<sub>b</sub></b> | 0.04 | <b>0.12</b>    | 0.05 | <b>0.32***</b>       | 0.04 | <b>0.17***</b> | 0.04 | -0.06           | 0.05 | -0.10                 | 0.04 |
| <b>Openness</b>            | Grade 5 | <b>0.45***</b>             | 0.07 | <b>0.13</b>    | 0.07 | 0.30***              | 0.07 | 0.13           | 0.06 | 0.00            | 0.07 | -0.17***              | 0.05 |
|                            | Grade 7 | <b>0.42***</b>             | 0.05 | <b>0.20***</b> | 0.06 | 0.23***              | 0.05 | 0.12           | 0.06 | -0.09           | 0.05 | -0.19***              | 0.05 |
|                            | Grade 9 | <b>0.39***</b>             | 0.04 | <b>0.20***</b> | 0.05 | 0.16**               | 0.05 | 0.05           | 0.06 | 0.04            | 0.06 | -0.11                 | 0.05 |
| <b>Agreeableness</b>       | Grade 5 | <b>0.46***<sub>a</sub></b> | 0.06 | <b>0.13</b>    | 0.07 | 0.28***              | 0.06 | 0.09           | 0.05 | -0.00           | 0.06 | -0.12**               | 0.05 |
|                            | Grade 7 | <b>0.33***</b>             | 0.05 | <b>0.09</b>    | 0.05 | 0.20***              | 0.04 | 0.16**         | 0.06 | -0.10           | 0.05 | -0.14**               | 0.05 |
|                            | Grade 9 | 0.25*** <sub>b</sub>       | 0.05 | 0.14**         | 0.05 | 0.14**               | 0.05 | 0.12           | 0.05 | -0.10           | 0.06 | -0.18***              | 0.05 |
| <b>Conscientiousness</b>   | Grade 5 | <b>0.40***</b>             | 0.05 | <b>0.19**</b>  | 0.06 | 0.20**               | 0.07 | 0.20***        | 0.05 | -0.11           | 0.06 | -0.21***              | 0.04 |
|                            | Grade 7 | <b>0.38***</b>             | 0.04 | <b>0.20***</b> | 0.05 | 0.26***              | 0.04 | 0.22***        | 0.05 | -0.10           | 0.04 | -0.14***              | 0.04 |
|                            | Grade 9 | <b>0.30***</b>             | 0.04 | <b>0.15**</b>  | 0.06 | 0.15***              | 0.04 | 0.10           | 0.05 | -0.08           | 0.05 | -0.16***              | 0.04 |
| <b>Model fit range</b>     | CFI     | .95-.97                    |      | .95-.98        |      | .94-.97              |      | .94-.98        |      | .94-.96         |      | .95-.97               |      |
|                            | RMSEA   | .04-.05                    |      | .03-.07        |      | .04-.06              |      | .04-.07        |      | .04-.05         |      | .04-.07               |      |
|                            | SRMR    | .02-.03                    |      | .02-.03        |      | .03                  |      | .02-.03        |      | .02-.03         |      | .02-.03               |      |

Note. All effects were controlled for gender, IQ, socioeconomic status, and immigration status. Indices a and b indicate that regression weights differ between grades at  $p < .01$ . Bold values show significant differences in regression weights between raters at  $p < .01$ .  $N = 2,667$ .

\*\*  $p < .01$ . \*\*\*  $p < .001$ .

## **Personality and Achievement**

### ***German and Mathematics School Grades***

In contrast to previous studies, we found positive associations between all self-reported personality factors and school grades in German and mathematics (Table 2). Most associations between personality and grades were found in seventh-graders. In ninth-graders, the results were more in line with previous work, as only openness and conscientiousness yielded significant associations with grades. Statistically testing grade-differential effects illustrated that adolescents in seventh grade with higher levels of extraversion reported better grades, whereas in ninth grade, extraversion was unrelated to German and mathematics school grades.

Overall, parent-rated personality resulted in fewer associations. Parent-reported emotional stability, openness, and conscientiousness were related to better German and mathematics school grades in seventh grade, whereas only conscientiousness showed positive associations with German and mathematics school grades in ninth grade. Despite this pattern, Wald tests comparing associations between seventh and ninth graders illustrated no statistically significant differences in the associations.

Importantly, all significant associations with parent-rated personality were congruent with the self-reported personality effects. However, rater-differential tests showed that associations between extraversion and both school grades were substantially stronger for the self-ratings than the parent ratings in seventh grade.

### ***Reading and Mathematics Achievement Tests***

Comparable to the German grade associations, each of the self-reported Big Five traits were positively associated with reading achievement test scores. Specifically, the effects of extraversion, agreeableness, and conscientiousness were significant only in the fifth and seventh grades, whereas the associations with emotional stability and openness were substantial across all three grades. However, the grade-differential results illustrated that emotional stability and extraversion showed significantly higher associations in younger age groups. A similar pattern emerged for the associations between personality and mathematics competence: In the fifth and seventh grades, all Big Five factors, except for agreeableness, which had no association, showed positive associations with mathematics competence. The only grade-consistent significant association was found for emotional stability: A higher level of emotional stability was related to higher scores on the mathematics achievement tests in Grades 5, 7, and 9. Grade-differential tests indicated significantly higher associations in lower grades for extraversion and openness.

Students with higher parent ratings on emotional stability and openness also showed higher achievement test scores. Associations with emotional stability were most pronounced in fifth grade, whereas openness showed consistent associations in all grades. Wald tests indicated no statistically significant differences between grades in the models of parent-reported personality and achievement tests.

Parent-reported personality effects were largely congruent with the effects of self-reported personality. However, the rater-differential tests highlighted that in seventh grade, the association between emotional stability and reading competence was substantially stronger for self- than for parent-reported personality.

## **Personality and Social Relationships**

### ***Helpfulness***

All Big Five personality factors were positively related to helpful behavior rated by classmates in at least one grade. Despite this general interrelatedness, the Big Five showed largely differential significance patterns across the three grades. In fifth grade, higher self-reported emotional stability and agreeableness were related to being rated as more helpful by classmates, whereas in seventh grade, all traits were consistently associated with helpfulness ratings. In ninth grade, higher self-ratings of conscientiousness were positively related to helpfulness. As a consistent effect, students with higher openness levels were rated as more helpful by their classmates across all grades. Despite such differential significance levels, we found no statistically significant differences between grades according to the Wald test.

Along with the self-ratings of personality, the parent-rated personality traits were all positively related to helpfulness. Contrary to self-reports, students with higher levels of parent-rated openness showed one positive association in fifth grade, whereas adolescents with higher parent-rated agreeableness and conscientiousness were perceived as more helpful in the fifth and ninth grades. Parent-rated extraversion was positively related to more helpful behavior in the seventh and ninth grades. As a consistent effect, emotional stability was related to helpfulness across all grades. However, similar to self-ratings, Wald tests did not reveal any statistically significant differences between grades.

Interestingly, classmates' ratings of helpfulness appeared to be an indicator with many incongruent associations when looking at the effects of self- and parent-rated personality. Despite this incongruency, statistical tests did not establish significant differences between raters.

### ***Aggressiveness***

Results concerning the associations between self-rated personality and average classmate ratings of aggressive behavior illustrated that adolescents with high self-ratings on openness, agreeableness, and conscientiousness were perceived as less aggressive by their classmates. Agreeableness was relevant across all three grades, whereas higher conscientiousness was only associated with less aggressive behavior in the seventh and ninth grades, and openness was associated with less aggressive behavior only in ninth grade. Despite these patterns, Wald tests did not indicate any significant differences between grade-specific effects.

Adolescents who were perceived as more agreeable and conscientious by their parents were also rated as less aggressive by their classmates. These associations were significant in all grades. In line with these consistent patterns, there were no significant differences between fifth-, seventh-, and ninth-graders as tested by the Wald test.

The results on classmate reports of aggressive behavior were largely congruent across self- and parent-rated personality. Again, we found no significant differences between raters.

### ***Teacher-Student Relationships***

Overall, personality was positively related to the quality of the teacher-student relationship. Agreeable and conscientious adolescents gave higher ratings to the quality of the teacher-student relationship across all three grades, whereas higher ratings on emotional stability, extraversion, and openness were related to higher quality of the teacher-student relationship in fifth and seventh but not in ninth grade. Grade-differential tests supported this notion of significantly higher associations in lower grades but only for emotional stability and extraversion.

Parent-rated extraversion, agreeableness, and conscientiousness were positively related to the quality of the teacher-student relationship, but only in seventh grade. Additionally, conscientiousness was significantly related to teacher-student relationship quality in ninth grade. Interestingly, none of the Wald tests revealed any statistically significant differences across grades.

Despite the existence of fewer associations in the context of parent-rated personality, these selected associations were found to be congruent with those of self-reported personality in adolescence. Testing for rater-differential results, only self-perceived extraversion was substantially and more strongly related to the teacher-student relationship in fifth grade.

## **Personality and Psychosocial Adjustment**

### ***Self-Esteem***

Students with higher ratings on emotional stability, extraversion, openness, agreeableness, and conscientiousness also reported higher self-esteem. Significant associations were found across all grades. Although the effects tended to be stronger in fifth than in ninth grade in all models, statistically significant grade-specific differences were only found in the models for extraversion and agreeableness.

Similar to adolescents' reports, all parent-rated personality traits were associated with self-esteem at least in one grade. In contrast to self-ratings, almost all associations with parent-reported personality occurred in the seventh and ninth grades, whereas only higher conscientiousness ratings were positively associated with self-esteem across all grades. Despite such patterns, Wald tests indicated no significant grade-specific effects.

Again, we found fewer associations of parent-rated personality with self-esteem, but these associations were congruent with those from self-reported personality. Interestingly, almost all associations were significantly smaller within the parent-reports than the self-reports.

### ***Well-Being in School***

In general, personality was positively associated with well-being in school. These associations were again found across all grades. Despite differences in estimated effect sizes, Wald tests showed no significant differences across the three grades.

With respect to parent reports, we found positive associations for emotional stability, extraversion, agreeableness, and conscientiousness. Higher parent-rated conscientiousness in the fifth and seventh grades, higher agreeableness in seventh grade, and higher parent-rated extraversion in the seventh and ninth grades were related to higher well-being in school. Only students with higher parent ratings on emotional stability reported more well-being in school across all grades. As with the self-reports, we found no statistically significant differences between grades based on the Wald test results.

We again found fewer significant associations with parent-rated personality than with the self-ratings. In contrast to the self-ratings, parent-rated openness was unrelated to well-being in school, but all further associations were congruent across raters. However, associations within parent ratings were again significantly lower in the model for emotional stability in fifth grade and in the model for extraversion across all grades.

### ***Somatoform Health Problems***

As the single significant association for personality self-ratings, higher levels of emotional stability were related to fewer health problems reported by their parents in seventh grade. The Wald test did not reveal statistically significant grade-specific effects.

A different pattern emerged with respect to the associations between the parent-rated personality of their children and parent-rated health problems: All of the parent-rated Big Five traits were negatively associated with health problems. Higher parent-rated openness in fifth and seventh grade, extraversion in seventh grade, as well as emotional stability, agreeableness, and conscientiousness across all grades were related to fewer parent-reported health problems. The differences between grades reached statistical significance in the models for emotional stability and extraversion, indicating stronger associations in seventh compared with fifth grade.

In this domain of psychosocial adjustment, we found fewer statistically significant associations of self-rated personality compared with parent-reported personality. The one association with self-rated emotional stability was congruent with parent reports. Despite this discrepancy in result patterns across raters, we found no statistically significant differences.

### **Robustness Check with Immigration Status**

Findings of our robustness analyses with immigration status indicate that the pattern of results between personality and the selected variables of psychosocial functioning are comparable for students with and without immigration status. Overall, we did not find evidence for interaction effects between personality and immigration status except for two effects in grade 9. The association between openness and aggressive behavior was more negative for students with an immigration status than for native students. Unexpectedly, the association between conscientiousness and German school grades was less positive for students with an immigration status. Tables OS 9 to 11 summarize the unstandardized parameters of these analyses for each grade separately.

## **Discussion**

The aim of the current study was to improve the understanding of age- and rater-differential interrelatedness between personality and psychosocial functioning in adolescence. We did so by investigating the associations of personality traits with different psychosocial functioning variables based on self-reports (school grades, teacher-student relationship, self-esteem, and well-being in school), peer reports (helpfulness and aggression), parent reports (health problems), and standardized assessments (academic achievement tests). Moreover, we examined self- and parent-

rated personality associations across three different grades and additionally tested for differences between self- and parent reports. In line with research in adulthood, we found that personality and psychosocial functioning were highly interrelated in adolescence. Specifically, academic achievement was most consistently associated with emotional stability, openness, and conscientiousness, whereas agreeableness and conscientiousness showed the most consistent associations with social relationships, and all Big Five personality traits were associated with all adjustment indicators across adolescence. Interestingly, only a few age-differential associations occurred, and parent ratings of adolescents' personality largely supported the associations with self-rated personality, albeit showing fewer effects. An interesting exception to these patterns was found for extraversion. Our study emphasized the role of personality in adolescence in a comprehensive and contextualized fashion with respect to a complex sample structure as well as psychosocial functioning variables. Thus, we hope to fuel further personality research in a still greatly understudied but very interesting period in life.

### **The Interrelatedness of Personality and Psychosocial Functioning**

In line with notions that personality can be associated with many life outcomes in adulthood (Roberts et al., 2007), our results point to an interrelatedness between personality and psychosocial functioning across adolescence. Similar to what occurs in adulthood, personality can function as a resource for mastering developmental tasks in adolescence, whereas at the same time, different experiences in adolescence might also promote personality development. Besides largely replicating the associations of conscientiousness, openness, and emotional stability with achievement, agreeableness and conscientiousness were related to well-functioning social relationships, and all traits mattered for psychosocial adjustment. In the following paragraphs, we discuss the overall associations between personality and psychosocial functioning, whereas in the upcoming sections, we delve more deeply into differential association patterns for both age and raters.

#### ***Academic Achievement***

Consistent with our hypotheses and existing research, conscientiousness and openness were associated with both achievement indicators across the two subjects, German and mathematics (e.g., Dumfart & Neubauer, 2016; Spengler et al., 2013). In keeping with previous findings, conscientiousness showed slightly more associations with school grades, whereas openness had more associations with achievement tests (Brandt, Lechner, et al., 2020; Lechner et al., 2017; Meyer et al., 2019). These results support the assumption that conscientious students who work deliberately and thoroughly report better grades. Even when controlling for intelligence,

more open students showed better achievement. It has been argued that higher curiosity, creativity, and different learning strategies (Komarraju et al., 2011) enable students to show better achievement and, hence, be more likely to succeed in acquiring basic competencies such as reading. Additionally, consistent with earlier studies (Laidra et al., 2007; Lechner et al., 2017), higher levels of emotional stability were related to better achievement, further suggesting that low emotional stability is a vulnerability factor. Most studies assume that personality characteristics shape the way we learn rather than the other way around. However, a first longitudinal study showed that the experience of competence (i.e., getting good grades and successfully acquiring new competencies) was related to adolescents' motivation to work harder, enjoyment of learning, and curiosity (Israel et al., 2019). Further longitudinal research during adolescence is needed to disentangle the direction of effects.

### ***Social Relationships***

Extending previous evidence, we showed that adolescents' personality was also associated with all three social relationship variables. This is particularly interesting as two of the constructs (i.e., helpfulness and aggressiveness) were not assessed as self-reports but constitute valid average scores rated by classmates in an entire classroom, thus highlighting the validity of these associations.

As hypothesized and in line with previous research (Harris & Vazire, 2016; Tackett et al., 2014), agreeableness and conscientiousness were consistently related to the social relationship variables. This fits and extends the findings from Jensen-Campbell et al. (2003), who identified agreeableness as the most important personality trait for interpersonal relations among elementary school students. Likewise, a student's conscientiousness was relevant for social relationships in the school context. This is in line with previous findings that showed a higher relevance of conscientiousness with respect to lower antisocial behavior, higher peer acceptance (Jensen-Campbell & Malcolm, 2007; Möttus et al., 2012), and a better teacher-student relationship (Zee et al., 2013).

School is a place that evokes and rewards agreeable and conscientious behavior (Wentzel, 2009). Being more compliant, diligent, and responsible is also linked to better achievement in school (Poropat, 2009). Thus, having good grades (conscientiousness) and the willingness to share knowledge with one's classmates (agreeableness) makes a student more likely to help others (e.g., with schoolwork). These kinds of students will hence be more likely to be perceived as helpful and are probably also liked more by classmates and teachers (Juvonen, 2006). At the same time, experiencing positive relationships could also foster agreeable and conscientious behavior with others. The roles and synergy of these traits (i.e., agreeableness and conscientiousness) for stable



and lasting relationships have already been highlighted in adult samples (Berry et al., 2000; Wagner et al., 2014) and appear to generalize to adolescence.

### ***Psychosocial Adjustment***

Our results indicate a remarkably consistent pattern of associations for all self-rated Big Five traits with self-esteem and well-being in school, which is in line with previous research in later adolescence and adulthood (Butkovic et al., 2012; Garcia, 2011; Robins et al., 2001). Relatively stable interindividual differences appear to matter for subjective well-being across diverse age groups and diverse contexts (Lucas, 2018). Importantly, the current study captured a comprehensive range of adjustment aspects that illustrated both consistent and differential effects.

Although emotional stability, extraversion, and conscientiousness showed strong effect sizes, contrary to our hypotheses, all traits were associated with psychosocial adjustment in early adolescence. One possible explanation can be found in the context of school where adolescents face many developmental tasks: Students with better grades also report higher self-esteem and more enjoyment when going to school (Metsäpelto et al., 2020; Pullmann & Allik, 2008). Possibly, the pertinent behaviors of openness and conscientiousness (e.g., enjoying learning and hard work) find a breeding ground in school and thus promote adjustment and well-being (Verkuyten & Thijs, 2002). The same holds for social traits such as extraversion and agreeableness: The enjoyment of many social encounters and social structures in school potentially increase students' well-being (Verkuyten & Thijs, 2002; Wentzel, 2017). Health is the only exception to these general adjustment associations. As results are suspected to largely depend on rater effects, these findings will be discussed in more depth in the respective section.

In summary, the results show that in adolescence, all Big Five personality traits are associated with a broad variety of psychosocial functioning variables assessed in a multimethodological way. Despite this general finding, our grade-differential and multi-informant approach hints at several differential patterns that are discussed in the following paragraphs. Moreover, as adolescence is a very disruptive phase, all variables—personality and psychosocial variables—are subject to changes. Thus, regarding the direction of effects, reciprocal effects should be expected and investigated in future longitudinal studies.

### **Grades Make a Difference – But Do They Really?**

To test for differential effects across adolescence, we applied two different strategies: First, and in line with previous studies (Laidra et al., 2006; Neuenschwander et al., 2013), we described similarities and differences in estimates and significance patterns, and second, we explicitly tested the differences by using pairwise comparisons and the multiparameter Wald test (Grund et al.,

2016). As the two strategies test different hypotheses (i.e., statistically significant associations within a group vs. statistically significant associations across groups) and could provide different results, we decided to report both strategies and integrate the findings in the following.

Regarding within-group associations, personality was especially likely to show associations with psychosocial functioning in Grades 5 and 7. With only a few exceptions with respect to parent ratings, personality associations were strongest in fifth grade and became weaker or even statistically nonsignificant in later grades. Although these findings are in line with some earlier studies (Laidra et al., 2007; Poropat, 2009; Tetzner et al., 2020), potential drivers of such differences are largely unknown. Poropat (2009) argued that weaker associations in secondary school, compared with primary school, might be due to an increasingly heterogeneous and more demanding environment, which could lead to more differentiated associations between personality and academic achievement. Although we were unable to compare primary, secondary, and tertiary educational settings, our study was based on a sample of secondary schools that serve disadvantaged communities. Thus, it provides results for a heterogeneous and understudied sample of students. However, because of this heterogeneity, we would like to argue that in early adolescence, we see a general interrelatedness between personality and psychosocial functioning, whereas over the course of middle and late adolescence, the role of personality and the relevance of different psychosocial variables become differentiated.

Nevertheless, we found one interesting result that can help explain an existing inconsistency in the literature, namely, the mixed associations of extraversion with academic achievement: Associations in previous studies range across positive, null, and negative effects (Laidra et al., 2007; Lechner et al., 2017; Poropat, 2009). With our more fine-grained grade-level analyses, results in the triangle between extraversion, achievement, and the teacher-student relationship appear to be particularly interesting. Being more energetic and sociable was related to better achievement and to a better teacher-student relationship quality in early but not in late adolescence. Interestingly, this positive association was previously found not only to diminish, but sometimes it even became negative in other samples (Eysenck & Eysenck, 1985; Laidra et al., 2007; Tetzner et al., 2020). One possible explanation that has been offered is that in later grades, adolescents with high scores on extraversion in particular become increasingly interested in peer relationships and social activities (Arnett, 2000; Chamorro-Premuzic & Furnham, 2008; Eysenck, 1992), which may entail an increasing avoidance of achievement-related tasks (Komarraju & Karau, 2005; Lubbers et al., 2010). Future longitudinal research might be able to shed light on the changing function of extraversion and its interrelatedness with diverse environments across adolescence.

Besides the results for extraversion and in contrast to our expectations, age-differential associations did not show clear patterns of differences between grades. Yet, we would like to argue that the results provide some indication of a general interrelatedness of personality and psychosocial functioning in early adolescence but a more differentiated picture of personality associations in later adolescence.

### **What Different Rater Perspectives Can (Not) Tell Us**

We further aimed to complement the understanding of associations of personality with psychosocial functioning in adolescence by including and comparing the self- and parent perspective. Again, first, we described similarities and differences in estimates and significance patterns, and second, we explicitly tested the differences between the associations from both perspectives. Student and parent ratings of personality showed both congruence and differences in their associations with psychosocial functioning as we hypothesized on the basis of the SOKA model (Vazire, 2010). Using the significance pattern within each domain of psychosocial functioning and between raters, we highlight three main findings.

First, although we found fewer and significantly lower associations with parent-reported personality compared with self-reports, existing effects were largely congruent between adolescent and parent reports. Results provide congruent associations of parent ratings with self-ratings in approximately 50% of all significant associations across all three domains of psychosocial functioning. With respect to each trait, the highest congruency was found for associations with conscientiousness (67%), confirming recent studies and the theoretical notions of the SOKA model (Branje et al., 2003; Göllner et al., 2017; Luan et al., 2017). Partly in line with previous findings and the SOKA model, congruence in associations of emotional stability with psychosocial functioning were also high (67%; cf. Luan et al., 2017; cf. van den Akker et al., 2014), and at the same time this trait showed significant differences in effect sizes between raters. Not supporting our hypothesis, most significant differences were found in associations with extraversion. These results were somewhat surprising because emotional stability has been regarded as difficult to observe for others, whereas extraverted behavior can be well-observed without being highly evaluative (Vazire, 2010). With respect to emotional stability, one might argue that parents still spend a lot of time with their adolescent children and might gain more insights into their inner thoughts and feelings than one might expect in different relationship settings. Referring to extraversion, early adolescence might be a time when especially extraversion develops through the mastering of developmental tasks outside the family home (Göllner et al., 2017; Havighurst, 1956). Extraversion might also be a very context-sensitive trait in this age span: The context of school (with many peer interactions) might evoke (and reward) other extraverted behavior levels

than the context of home (Fleeson, 2007; Nettle, 2005). Therefore, further other perspectives, such as personality ratings from peers, should be included in future studies, as they could provide an explanation for context-varying similarities and differences in personality-associations. Future longitudinal studies might also investigate whether and when (in)congruency in rater perspectives are useful for psychosocial functioning (Reitz et al., 2016). Together, parents might be better able to judge their children's emotional stability and conscientiousness, showing significant and consistent associations with psychosocial functioning in early adolescence, but they might be less precise with respect to extraversion.

Second, this congruency in effects across raters is particularly interesting in light of the bivariate correlation patterns (see Table OS 3), which showed stronger agreement between the personality ratings of adolescents and their parents in later grades. This is also reflected in the percentage of congruent effects between adolescents and their parents from fifth through ninth grade: In fifth grade, 37% of all effects from self-reported personality were also significant when parents rated their children's personality. In Grades 7 and 9, however, the percentages increased to 60% and 61%, respectively. Thus, from a developmental perspective, one might argue that the way adolescents see themselves is more aligned with how their parents perceive them (Luan et al., 2017; Rohrer et al., 2018).

Third, our study highlights the value of including different sources not only for personality but also for psychosocial functioning to test the robustness of findings. Beside the fact that most self-rated personality associations were also confirmed for parent-rated personality, it was especially valuable to include peer-rated variables. These different sources underlined the existence of personality-psychosocial functioning associations in adolescence regardless of the rater. However, making use of different sources additionally showed some distinct effects between raters. It is well-known that when personality and other variables are rated by the same source, associations are more likely and are often also stronger in size (Podsakoff et al., 2003). In our study, this was not only true with respect to self-rated constructs. Parent-rated personality also showed more and stronger associations with the parent-rated adjustment indicator, whereas self-rated personality did not. Besides possible substantive explanations, these effects point to the presence of common-method variance (Podsakoff et al., 2003). Notably, the part of the personality associations that is due to common-method variance seems to be higher when personality and psychosocial indicators are rated by parents than by adolescents. Departing from such within-person ratings, the peer-rated variables of helpfulness and aggressiveness were found to show both congruent and rater-specific associations. Helpfulness and aggressiveness are behaviors that are easy to observe, so other (peer) perspectives should provide reliable information (Reitz et al., 2016; Vazire & Mehl, 2008). As self- and parent-rated personality also showed single significant

associations, we cannot explain the association pattern through common-method variance, nor can we favor one perspective over the other. Thus, the two rater perspectives appear to provide different personality information and may be regarded as complementary to each other. Contrary to previous findings favoring other-reports when studying personality-achievement associations in adolescence (Connelly & Ones, 2010; Poropat, 2014b), in our study, the interrelatedness between personality and psychosocial functioning was also confirmed by self-reports.

Overall, we found a high congruence in personality associations between adolescents and parents. Although parent-reported personality associations almost always had smaller effect sizes, such congruence emphasizes the robustness of effects. However, the results also demonstrate the possible existence of common-method variance, particularly when both the dependent and independent variables are reported by others.

### **Limitations and Outlook**

Our study has many strengths as we investigated a broad range of psychosocial functioning indicators in three different grades by applying a multimethodological approach on the side of personality and psychosocial functioning in a large heterogeneous sample of adolescents and their parents. However, we also need to discuss four main limitations of our study.

To begin with, as is the case with all cross-sectional studies, we cannot draw any conclusions about the directions or causality of effects (see Morgan & Winship, 2015). Although first longitudinal empirical evidence indicates that psychosocial functioning can also explain personality change in adolescence (Brandt et al., 2019; Israel et al., 2019), these studies also point to larger effect sizes of personality on performance indicators or social relationships (as aspects of psychosocial functioning) than vice versa. This is in line with other longitudinal studies in adulthood (e.g., Deventer et al., 2019; Neyer & Asendorpf, 2001; Scollon & Diener, 2006; Sutin et al., 2009). Moreover, by including three different grades, we could not exclude the possibility of cohort effects when considering grade-differential tendencies. We interpreted these tendencies with caution and generally found only weak evidence for grade-specific associations. Therefore, the results have to be replicated with similar age groups in longitudinal studies to explicitly investigate potential effects of personality on psychosocial functioning and vice versa, beginning in early adolescence. Although we controlled for several covariates, alternative moderators need to be considered when studying the association between personality and psychosocial functioning such as interest, self-concept, or social feedback (Marsh & O'Mara, 2008; Wagner et al., 2018).

Second, although we think that investigating non-WEIRD (White, Educated, Industrialized, Rich, and Democratic, Heinrich et al., 2010) samples is important and necessary, it also raises the question of the findings' generalizability to the entire population, which might be

less disadvantaged than the sample we studied. In order to investigate the robustness of the results, we controlled all analyses for relevant covariates, such as gender, socioeconomic status, cognitive abilities, and immigration status. Most findings confirm the theoretically and empirically expected direction of effects. As investigations in culturally diverse samples are particularly scarce, the high percentage of first- and second-generation immigrants in our sample are a specificity allowing additional robustness analyses. Generally, our findings supported the robustness of the results with respect to two domains (social relationships and adjustment) but also showed changes in results with respect to the domain of academic achievement. The analyses revealed two significant interactions of immigration status with openness and conscientiousness, indicating that personality might show differential association patterns in these subgroups. Especially the reduced association between conscientiousness and German school grades for students with an immigration status might underscore a higher relevance of contextual factors compared to personality for this subgroup. Overall, replication of these effects is needed to shed light on whether group differences, for instance minority vs. non-minority groups, could help better to understand the conditions and samples in which personality might function as a resource or as a vulnerability factor with respect to psychosocial functioning.

Third, we found relatively high correlations between personality items and, thus, between the personality factors (Table OS 3). Therefore, it was not possible to implement a simple structure on the item level of the Big Five with confirmatory factor analyses in this sample. However, it is equally unlikely to find a simple structure on the item level among adult samples (Brandt, Becker et al., 2020; Marsh et al., 2013; see also Church & Burke, 1994; Vassend & Skrandal, 1997). Interpretations of the associations could contain method bias, whereas it was also reasonable to suggest that higher correlations in adolescence have substantive reasons. Adolescents might show different agreeable or extraverted behaviors than adults or the behavioral range might be smaller in adolescence than later on. To validate the personality self-reports, we included parent ratings and compared the two perspectives statistically. Future research, however, should place a methodological focus on disentangling the higher interrelatedness of factors and how this can be interpreted in associations between personality and variables of interest.

Fourth, our aim was to investigate age- and rater-specific associations of personality and a broad range of psychosocial functioning variables in the first phase of adolescence. We decided to include three different age groups and two different rater perspectives on personality to account for the specificities of this turbulent age period. This led to an extensive number of analyses and thus increased the risk of rejecting the null hypothesis by chance. To address this point, we restricted our  $p$ -value to  $p < .01$ . Additionally, we controlled our findings for multiple testing. As there is still disagreement about the use of multiple testing procedures (e.g., Saville, 1990), we

applied two different approaches one by Benjamini and Yekutieli (2001) and one by Benjamini and Hochberg (1995). This maximum level of transparency will help readers to form an opinion based on the different information. Results contrasting the original and the two adjusted  $p$ -values for all effects of interest can be found in the Online Supplement Tables OS 12-20. Importantly, we thereby contrast the (conservative) criterion of  $p < .01$  with the adjusted  $p$ -values using a cut-off of  $p < .05$ . Overall, the comparison of different criteria confirms the majority of the findings and support our current approach of a more restrictive  $p$ -value. Interestingly, the adjusted  $p$ -values of the procedure by Benjamini and Hochberg (1995) led to a more liberal testing than the alpha cut-off of  $p < .01$ , whereas the procedure by Benjamini and Yekutieli (2001) produced slightly more conservative decisions. In addition to some effects being omitted based on the correcting (especially differences between grades), several additional effects were added (mostly among the personality-psychosocial-functioning-associations). The discussed grade differences between extraversion and achievement, however, stayed significant. Regardless of the consistency of results across different adjustment procedures, future studies need to replicate our findings to draw final conclusions about the interplay of personality and psychosocial functioning in adolescence.

Finally, despite the large number of different associations, one can still think of other relevant psychosocial functioning variables. Future research might want to focus on resource-oriented variables such as resiliency or motivation. Moreover, additional other reports of adolescents' personalities, such as peer and teacher reports, could also shed light on the role of personality perspectives in adolescence (see for example Brandt et al., 2021; Plouffe et al., 2017; Reitz et al., 2016).

## **Conclusion**

In summary, the current article provides evidence for the strong interrelatedness of Big Five personality traits and psychosocial functioning in the domains of academic achievement, social relationships, and psychosocial adjustment. Thereby, school can be seen as a crucial context that confronts students with different developmental tasks and rewards (or punishes) certain behaviors. In this light, the adolescent school context bears substantial importance for individual resources such as personality. Although the majority of personality associations did not differ across grades, we found some evidence that particularly the associations with extraversion vary across adolescence. This emphasizes the notion of possible differentiated and changing roles of some personality traits, which may reflect a turbulent stage in life with shifting social demands and developmental tasks (Eccles & Roeser, 2011; Havighurst, 1956; Hogan & Roberts, 2004). Our multirater perspective additionally confirmed most self-rated personality effects, pointing to meaningful and robust results. Altogether, we hope we have provided a starting point for even

more detailed research on age- and rater-related personality phenomena. From our point of view, the most pressing next steps include longitudinal analyses to understand developmental trajectories in personality-outcome associations, differential functioning of personality traits, and the directions of the effects.



### Data Accessibility Statement

The data, analyses scripts used for this article, and an overview about the included variables can be accessed at [https://osf.io/pjdcx/?view\\_only=c5dd0469da8c43328b4d68242a920dd7](https://osf.io/pjdcx/?view_only=c5dd0469da8c43328b4d68242a920dd7).

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### Footnotes

1. For the sake of completeness, we report  $\chi^2$  difference tests in the Online Supplement Table OS 2 but do not use them for model fit evaluation as they are highly sensitive to trivial differences between specified models and empirical data.

## Appendix Study 1

Table OS1

Descriptive Statistics and Proportions of Missing Data for all Manifest Variables of Interest Differentiated Between the Three Grades

|                                      |                          | Total sample (N = 2667) |       |      |                  | Fifth grade (n = 738) |       |     |                  | Seventh grade (n = 986) |       |     |                  | Ninth grade (n = 943) |       |     |                  |
|--------------------------------------|--------------------------|-------------------------|-------|------|------------------|-----------------------|-------|-----|------------------|-------------------------|-------|-----|------------------|-----------------------|-------|-----|------------------|
|                                      |                          | M                       | SD    | n    | Missings<br>in % | M                     | SD    | n   | Missings<br>in % | M                       | SD    | n   | Missings<br>in % | M                     | SD    | n   | Missings<br>in % |
| <b>Personality students' ratings</b> | Emotional stability      | 3.43                    | 0.64  | 2132 | 20.06            | 3.40                  | 0.67  | 501 | 32.11            | 3.42                    | 0.63  | 863 | 12.47            | 3.47                  | 0.63  | 768 | 18.56            |
|                                      | Extraversion             | 3.63                    | 0.70  | 2153 | 19.27            | 3.59                  | 0.70  | 510 | 30.89            | 3.62                    | 0.67  | 871 | 11.66            | 3.68                  | 0.72  | 772 | 18.13            |
|                                      | Openness                 | 3.58                    | 0.62  | 2129 | 20.17            | 3.62                  | 0.69  | 500 | 32.25            | 3.56                    | 0.61  | 865 | 12.27            | 3.57                  | 0.59  | 764 | 18.98            |
|                                      | Agreeableness            | 3.49                    | 0.64  | 2141 | 19.72            | 3.61                  | 0.67  | 502 | 31.98            | 3.47                    | 0.64  | 869 | 11.87            | 3.44                  | 0.61  | 770 | 18.34            |
|                                      | Conscientiousness        | 3.46                    | 0.66  | 2137 | 19.87            | 3.54                  | 0.70  | 503 | 31.84            | 3.43                    | 0.65  | 866 | 12.17            | 3.43                  | 0.65  | 768 | 18.56            |
| <b>Personality parents' ratings</b>  | Emotional stability      | 3.55                    | 0.67  | 1913 | 28.27            | 3.55                  | 0.67  | 603 | 18.29            | 3.52                    | 0.63  | 648 | 34.28            | 3.58                  | 0.67  | 662 | 29.80            |
|                                      | Extraversion             | 3.83                    | 0.73  | 1954 | 26.73            | 3.95                  | 0.74  | 614 | 16.80            | 3.81                    | 0.70  | 663 | 32.76            | 3.75                  | 0.74  | 677 | 28.21            |
|                                      | Openness                 | 3.86                    | 0.63  | 1907 | 28.50            | 3.96                  | 0.64  | 600 | 18.70            | 3.81                    | 0.61  | 648 | 34.28            | 3.80                  | 0.62  | 659 | 30.12            |
|                                      | Agreeableness            | 3.82                    | 0.63  | 1923 | 27.90            | 3.91                  | 0.62  | 608 | 17.62            | 3.79                    | 0.60  | 651 | 33.98            | 3.76                  | 0.64  | 664 | 29.59            |
|                                      | Conscientiousness        | 3.41                    | 0.78  | 1916 | 28.16            | 3.45                  | 0.79  | 605 | 18.02            | 3.37                    | 0.75  | 650 | 34.08            | 3.42                  | 0.79  | 661 | 29.90            |
| <b>Achievement</b>                   | German school grade      | 3.74                    | 0.91  | 2044 | 23.36            | 4.14                  | 1.02  | 155 | 79.00            | 3.72                    | 0.96  | 965 | 2.13             | 3.69                  | 0.83  | 924 | 2.01             |
|                                      | Mathematics school grade | 3.65                    | 1.07  | 2022 | 24.18            | 4.17                  | 1.06  | 155 | 79.00            | 3.71                    | 1.09  | 964 | 2.23             | 3.49                  | 1.02  | 903 | 4.24             |
|                                      | Reading comp.            | 124.04                  | 30.65 | 2638 | 1.09             | 105.06                | 29.48 | 731 | 0.95             | 118.52                  | 24.55 | 978 | 0.81             | 144.80                | 24.56 | 929 | 1.48             |
|                                      | Mathematics comp.        | 117.41                  | 29.24 | 2625 | 1.57             | 103.25                | 29.80 | 729 | 1.22             | 115.73                  | 27.64 | 965 | 2.13             | 130.25                | 24.51 | 931 | 1.27             |
| <b>Social relationships</b>          | Helpful                  | 2.09                    | 0.52  | 2647 | 0.75             | 2.09                  | 0.48  | 720 | 2.44             | 1.99                    | 0.45  | 984 | 0.20             | 2.18                  | 0.60  | 943 | 0                |
|                                      | Aggressive               | 1.54                    | 0.50  | 2647 | 0.75             | 1.62                  | 0.54  | 720 | 2.44             | 1.57                    | 0.51  | 984 | 0.20             | 1.44                  | 0.42  | 943 | 0                |
|                                      | Teacher relationship     | 2.94                    | 0.63  | 2376 | 10.91            | 3.15                  | 0.61  | 643 | 12.87            | 2.94                    | 0.60  | 935 | 5.17             | 2.76                  | 0.62  | 798 | 15.38            |
| <b>Adjustment</b>                    | Self-esteem              | 2.99                    | 0.51  | 2160 | 19.01            | 2.99                  | 0.54  | 514 | 30.35            | 2.97                    | 0.51  | 887 | 10.04            | 3.02                  | 0.50  | 759 | 19.51            |
|                                      | Well-being in school     | 3.22                    | 0.52  | 2396 | 10.16            | 3.20                  | 0.54  | 652 | 11.65            | 3.24                    | 0.51  | 941 | 4.56             | 3.21                  | 0.52  | 803 | 14.84            |
|                                      | Health problems          | 0.20                    | 0.25  | 2034 | 23.73            | 0.16                  | 0.21  | 629 | 14.77            | 0.21                    | 0.24  | 711 | 27.89            | 0.22                  | 0.27  | 694 | 26.41            |
| <b>Covariates</b>                    | Gender                   | 0.50                    | 0.50  | 2661 | 0.22             | 0.50                  | 0.50  | 737 | 0.14             | 0.48                    | 0.50  | 984 | 0.20             | 0.52                  | 0.50  | 940 | 0.32             |
|                                      | IQ                       | 101.84                  | 15.02 | 2621 | 1.72             | 100.94                | 15.77 | 728 | 1.36             | 100.62                  | 14.92 | 964 | 2.23             | 103.81                | 14.34 | 929 | 1.48             |
|                                      | Number of books          | 0.57                    | 0.49  | 2080 | 22.01            | 0.57                  | 0.50  | 647 | 12.33            | 0.55                    | 0.50  | 725 | 26.47            | 0.60                  | 0.49  | 708 | 24.92            |
|                                      | Immigration status       | 0.40                    | 0.49  | 2551 | 4.35             | 0.38                  | 0.49  | 707 | 4.20             | 0.41                    | 0.49  | 901 | 8.62             | 0.40                  | 0.49  | 943 | 0                |

Note. Grades were recoded so that higher numbers indicate better performance. The variables gender (1 = female), number of books (1 = more than 50 books at home), and immigration status (1 = yes) were dummy-coded.



**Table OS 2**  
 $\chi^2$  Difference Tests of MI Personality Models Across Grades (5, 7, and 9) and Self- and Parent Ratings with Item Parcels

| Model                      | Model set 1                          |          |                |             |   | Model set 2                            |          |                |             |   | Model set 3                        |           |                |             |        |
|----------------------------|--------------------------------------|----------|----------------|-------------|---|--|----------|----------------|-------------|---|------------------------------------|-----------|----------------|-------------|--------|
|                            | MI across grades within self-ratings |          |                |             |   | MI across grades within parent ratings |          |                |             |   | MI across self- and parent ratings |           |                |             |        |
|                            | $\chi^2$                             | df       | $\Delta\chi^2$ | $\Delta df$ | p | $\chi^2$                               | df       | $\Delta\chi^2$ | $\Delta df$ | p | $\chi^2$                           | df        | $\Delta\chi^2$ | $\Delta df$ | p      |
| <b>Emotional stability</b> | Configural invariance                |          | 0              |             |   |  | 0        |                |             |   | 31.106**                           | 8         |                |             |        |
|                            | Weak invariance                      | 6.700    | 4              |             |   | 2.928                                  | 4        |                |             |   | 36.553**                           | 10        | 5.447          | 2           | .066   |
|                            | Strong invariance                    | 18.089*  | 8              | 11.389*     | 4 | .023                                   | 6.669    | 8              | 3.741       | 4 | .442                               | 167.422** | 12             | 130.869***  | 2      |
| <b>Extraversion</b>        | Configural invariance                |          | 0              |             |   |  | 0        |                |             |   | 40.238**                           | 8         |                |             |        |
|                            | Weak invariance                      | 7.618    | 4              |             |   | 12.912*                                | 4        |                |             |   | 47.673**                           | 10        | 7.435*         | 2           | .024   |
|                            | Strong invariance                    | 39.911** | 8              | 32.293***   | 4 | < .001                                 | 26.094** | 8              | 13.182*     | 4 | .010                               | 78.846**  | 12             | 31.173***   | 2      |
| <b>Openness</b>            | Configural invariance                |          | 0              |             |   |  | 0        |                |             |   | 62.942**                           | 8         |                |             |        |
|                            | Weak invariance                      | 3.831    | 4              |             |   | 5.296                                  | 4        |                |             |   | 71.056**                           | 10        | 8.114*         | 2           | .017   |
|                            | Strong invariance                    | 44.721** | 8              | 40.890***   | 4 | < .001                                 | 14.057   | 8              | 8.761       | 4 | .067                               | 96.507**  | 12             | 25.451***   | 2      |
| <b>Agreeableness</b>       | Configural invariance                |          | 0              |             |   |  | 0        |                |             |   | 34.312**                           | 8         |                |             |        |
|                            | Weak invariance                      | 8.068    | 4              |             |   | 3.272                                  | 4        |                |             |   | 45.513**                           | 10        | 11.201**       | 2           | .004   |
|                            | Strong invariance                    | 30.765** | 8              | 22.697***   | 4 | < .001                                 | 23.236** | 8              | 19.964***   | 4 | < .001                             | 85.978**  | 12             | 40.465***   | 2      |
| <b>Conscientiousness</b>   | Configural invariance                |          | 0              |             |   |  | 0        |                |             |   | 45.733**                           | 8         |                |             |        |
|                            | Weak invariance                      | 14.267** | 4              |             |   | 3.513                                  | 4        |                |             |   | 69.678**                           | 10        | 23.945***      | 2           | < .001 |
|                            | Strong invariance                    | 23.163** | 8              | 8.896       | 4 | .064                                   | 18.538*  | 8              | 15.025***   | 4 | .005                               | 181.325** | 12             | 111.647***  | 2      |

\*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ .

**Table OS 3***Bivariate Correlations of all Relevant Variables of the Total Sample (N = 2,667)*

|                               |                             | 1           | 2           | 3           | 4           | 5           | 6           | 7           | 8           | 9           | 10          | 11          | 12          | 13          | 14          | 15          | 16          | 17          | 18          | 19          | 20          | 21          | 22          | 23          |  |  |
|-------------------------------|-----------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|--|--|
| Personality students' ratings | Emotional stability (1)     |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |  |  |
|                               | Extraversion (2)            | <b>.57</b>  |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |  |  |
|                               | Openness (3)                | <b>.53</b>  | <b>.47</b>  |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |  |  |
|                               | Agreeableness (4)           | <b>.46</b>  | <b>.42</b>  | <b>.49</b>  |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |  |  |
| Personality parents' ratings  | Conscientiousness (5)       | <b>.44</b>  | <b>.39</b>  | <b>.54</b>  | <b>.53</b>  |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |  |  |
|                               | Emotional stability (6)     | <b>.37</b>  | <b>.29</b>  | <b>.26</b>  | <b>.21</b>  | <b>.22</b>  |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |  |  |
|                               | Extraversion (7)            | <b>.27</b>  | <b>.41</b>  | <b>.19</b>  | <b>.15</b>  | <b>.12</b>  | <b>.61</b>  |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |  |  |
|                               | Openness (8)                | <b>.28</b>  | <b>.24</b>  | <b>.43</b>  | <b>.25</b>  | <b>.23</b>  | <b>.55</b>  | <b>.53</b>  |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |  |  |
| Achievement                   | Agreeableness (9)           | <b>.20</b>  | <b>.11</b>  | <b>.17</b>  | <b>.32</b>  | <b>.17</b>  | <b>.50</b>  | <b>.40</b>  | <b>.48</b>  |             |             |             |             |             |             |             |             |             |             |             |             |             |             |             |  |  |
|                               | Conscientiousness (10)      | <b>.22</b>  | <b>.16</b>  | <b>.24</b>  | <b>.22</b>  | <b>.46</b>  | <b>.48</b>  | <b>.31</b>  | <b>.46</b>  | <b>.43</b>  |             |             |             |             |             |             |             |             |             |             |             |             |             |             |  |  |
|                               | German grade (11)           | <b>.21</b>  | <b>.17</b>  | <b>.31</b>  | <b>.22</b>  | <b>.25</b>  | <b>.17</b>  | <b>.08</b>  | <b>.28</b>  | <b>.09</b>  | <b>.27</b>  |             |             |             |             |             |             |             |             |             |             |             |             |             |  |  |
|                               | Mathematics grade (12)      | <b>.14</b>  | <b>.00</b>  | <b>.24</b>  | <b>.15</b>  | <b>.16</b>  | <b>.14</b>  | <b>.00</b>  | <b>.23</b>  | <b>.07</b>  | <b>.20</b>  | <b>.57</b>  |             |             |             |             |             |             |             |             |             |             |             |             |  |  |
| Social relationships          | Reading competence (13)     | <b>.24</b>  | <b>.13</b>  | <b>.29</b>  | <b>.13</b>  | <b>.06</b>  | <b>.15</b>  | <b>.02</b>  | <b>.25</b>  | <b>.03</b>  | <b>.05</b>  | <b>.25</b>  | <b>.17</b>  |             |             |             |             |             |             |             |             |             |             |             |  |  |
|                               | Mathematics competence (14) | <b>.21</b>  | <b>.07</b>  | <b>.26</b>  | <b>.09</b>  | <b>.05</b>  | <b>.16</b>  | <b>.00</b>  | <b>.27</b>  | <b>.02</b>  | <b>.09</b>  | <b>.30</b>  | <b>.45</b>  | <b>.57</b>  |             |             |             |             |             |             |             |             |             |             |  |  |
|                               | Helpfulness (15)            | <b>.13</b>  | <b>.15</b>  | <b>.16</b>  | <b>.15</b>  | <b>.18</b>  | <b>.19</b>  | <b>.11</b>  | <b>.13</b>  | <b>.14</b>  | <b>.17</b>  | <b>.24</b>  | <b>.12</b>  | <b>.20</b>  | <b>.15</b>  |             |             |             |             |             |             |             |             |             |  |  |
|                               | Aggressiveness (16)         | <b>-.10</b> | <b>-.07</b> | <b>-.12</b> | <b>-.28</b> | <b>-.18</b> | <b>-.12</b> | <b>.03</b>  | <b>-.07</b> | <b>-.20</b> | <b>-.18</b> | <b>-.19</b> | <b>-.09</b> | <b>-.14</b> | <b>-.10</b> | <b>-.32</b> |             |             |             |             |             |             |             |             |  |  |
| Adjustment                    | Teacher relationship (17)   | <b>.14</b>  | <b>.14</b>  | <b>.14</b>  | <b>.23</b>  | <b>.20</b>  | <b>.11</b>  | <b>.11</b>  | <b>.12</b>  | <b>.15</b>  | <b>.19</b>  | <b>.17</b>  | <b>.14</b>  | <b>-.05</b> | <b>-.03</b> | <b>.10</b>  | <b>-.12</b> |             |             |             |             |             |             |             |  |  |
|                               | Self-esteem (18)            | <b>.47</b>  | <b>.35</b>  | <b>.38</b>  | <b>.31</b>  | <b>.31</b>  | <b>.25</b>  | <b>.19</b>  | <b>.24</b>  | <b>.18</b>  | <b>.21</b>  | <b>.17</b>  | <b>.12</b>  | <b>.17</b>  | <b>.15</b>  | <b>.09</b>  | <b>-.06</b> | <b>.22</b>  |             |             |             |             |             |             |  |  |
|                               | Well-being in school (19)   | <b>.29</b>  | <b>.35</b>  | <b>.19</b>  | <b>.19</b>  | <b>.20</b>  | <b>.21</b>  | <b>.26</b>  | <b>.13</b>  | <b>.16</b>  | <b>.19</b>  | <b>.15</b>  | <b>.07</b>  | <b>.02</b>  | <b>.05</b>  | <b>.12</b>  | <b>-.05</b> | <b>.32</b>  | <b>.44</b>  |             |             |             |             |             |  |  |
| Covariates                    | Health problems (20)        | <b>-.19</b> | <b>-.10</b> | <b>-.07</b> | <b>-.12</b> | <b>-.11</b> | <b>-.26</b> | <b>-.18</b> | <b>-.18</b> | <b>-.19</b> | <b>-.17</b> | <b>-.05</b> | <b>-.09</b> | <b>-.03</b> | <b>-.07</b> | <b>-.01</b> | <b>.05</b>  | <b>-.14</b> | <b>-.18</b> | <b>-.13</b> |             |             |             |             |  |  |
|                               | Gender (21)                 | <b>.02</b>  | <b>.16</b>  | <b>.03</b>  | <b>.23</b>  | <b>.16</b>  | <b>.01</b>  | <b>.10</b>  | <b>.02</b>  | <b>.04</b>  | <b>.15</b>  | <b>.21</b>  | <b>-.05</b> | <b>.04</b>  | <b>-.16</b> | <b>.13</b>  | <b>-.29</b> | <b>.08</b>  | <b>-.06</b> | <b>.08</b>  | <b>.07</b>  |             |             |             |  |  |
|                               | IQ (22)                     | <b>.13</b>  | <b>.07</b>  | <b>.22</b>  | <b>.11</b>  | <b>.05</b>  | <b>.11</b>  | <b>-.04</b> | <b>.25</b>  | <b>.02</b>  | <b>.06</b>  | <b>.25</b>  | <b>.36</b>  | <b>.43</b>  | <b>.57</b>  | <b>.12</b>  | <b>-.10</b> | <b>.01</b>  | <b>.07</b>  | <b>-.01</b> | <b>-.08</b> | <b>-.02</b> |             |             |  |  |
|                               | Number of books (23)        | <b>.11</b>  | <b>.04</b>  | <b>.21</b>  | <b>.14</b>  | <b>.05</b>  | <b>.05</b>  | <b>.02</b>  | <b>.20</b>  | <b>.09</b>  | <b>.01</b>  | <b>.16</b>  | <b>.13</b>  | <b>.24</b>  | <b>.26</b>  | <b>.01</b>  | <b>-.15</b> | <b>-.02</b> | <b>.08</b>  | <b>-.03</b> | <b>-.06</b> | <b>.00</b>  | <b>.16</b>  |             |  |  |
|                               | Immigration status (24)     | <b>-.08</b> | <b>-.03</b> | <b>-.06</b> | <b>-.04</b> | <b>.07</b>  | <b>-.01</b> | <b>.01</b>  | <b>-.10</b> | <b>-.11</b> | <b>.10</b>  | <b>-.14</b> | <b>-.11</b> | <b>-.27</b> | <b>-.24</b> | <b>-.05</b> | <b>.17</b>  | <b>-.02</b> | <b>-.01</b> | <b>.09</b>  | <b>.12</b>  | <b>.02</b>  | <b>-.16</b> | <b>-.27</b> |  |  |

Note. Grades were recoded so that higher numbers indicate better performance. The variables gender (1 = female), number of books (1 = more than 50 books at home), and immigration status (1 = yes) were dummy-coded. Bold values are significant at  $p < .01$ .

**Table OS 4**

*Manifest Intercorrelations of Students' and Parents' Personality across and Differentiated between all Grades*

|                      | <b>ES</b> | <b>E</b> | <b>O</b> | <b>A</b> | <b>C</b> |
|----------------------|-----------|----------|----------|----------|----------|
| <i>Whole sample</i>  |           |          |          |          |          |
| Emotional stability  | .31       | .57      | .53      | .48      | .43      |
| Extraversion         | .53       | .35      | .49      | .40      | .25      |
| Openness             | .49       | .48      | .40      | .50      | .44      |
| Agreeableness        | .40       | .41      | .47      | .32      | .44      |
| Conscientiousness    | .43       | .40      | .52      | .51      | .43      |
| <i>Fifth grade</i>   |           |          |          |          |          |
| Emotional stability  | .17       | .58      | .55      | .51      | .45      |
| Extraversion         | .47       | .24      | .51      | .43      | .24      |
| Openness             | .46       | .50      | .31      | .53      | .44      |
| Agreeableness        | .43       | .52      | .53      | .24      | .45      |
| Conscientiousness    | .44       | .42      | .50      | .52      | .32      |
| <i>Seventh grade</i> |           |          |          |          |          |
| Emotional stability  | .33       | .55      | .54      | .48      | .44      |
| Extraversion         | .57       | .36      | .51      | .39      | .22      |
| Openness             | .56       | .52      | .44      | .49      | .39      |
| Agreeableness        | .44       | .39      | .46      | .33      | .43      |
| Conscientiousness    | .47       | .42      | .51      | .51      | .45      |
| <i>Ninth grade</i>   |           |          |          |          |          |
| Emotional stability  | .39       | .58      | .51      | .48      | .41      |
| Extraversion         | .52       | .44      | .44      | .37      | .27      |
| Openness             | .45       | .45      | .42      | .47      | .47      |
| Agreeableness        | .34       | .37      | .43      | .35      | .42      |
| Conscientiousness    | .40       | .39      | .56      | .50      | .49      |

*Note.* Below the diagonal are the intercorrelations of the personality factors rated by the students. Above the diagonal are the intercorrelations of the personality factors rated by the parents. The diagonal shows the correlation between raters for each personality trait. All correlations are significant at  $p < .001$ .  $N = 2,667$ .

Table OS 5

Standardized Effects of Self- and Parent-Reported Personality on the Four Achievement Variables in Grades 5, 7, and 9

| Emotional Stability      |                    | German school grade |      |         |      | Mathematics school grade |      |         |      | Reading competence |      |          |      | Mathematics competence |      |          |      |
|--------------------------|--------------------|---------------------|------|---------|------|--------------------------|------|---------|------|--------------------|------|----------|------|------------------------|------|----------|------|
|                          |                    | Adolescents         |      | Parents |      | Adolescents              |      | Parents |      | Adolescents        |      | Parents  |      | Adolescents            |      | Parents  |      |
|                          |                    | $\beta$             | SE   | $\beta$ | SE   | $\beta$                  | SE   | $\beta$ | SE   | $\beta$            | SE   | $\beta$  | SE   | $\beta$                | SE   | $\beta$  | SE   |
| <b>Fifth grade</b>       |                    |                     |      |         |      |                          |      |         |      |                    |      |          |      |                        |      |          |      |
| <i>Personality</i>       | ES                 | 0.03                | 0.14 | 0.03    | 0.08 | 0.11                     | 0.15 | 0.05    | 0.08 | 0.27***            | 0.06 | 0.12**   | 0.04 | 0.23***                | 0.05 | 0.11**   | 0.04 |
| <i>Control variables</i> | Gender             | 0.08                | 0.07 | 0.08    | 0.07 | 0.02                     | 0.06 | 0.01    | 0.06 | 0.02               | 0.03 | 0.00     | 0.03 | -0.20***               | 0.03 | -0.22*** | 0.03 |
|                          | IQ                 | 0.11                | 0.06 | 0.11    | 0.06 | 0.11                     | 0.06 | 0.12    | 0.06 | 0.36***            | 0.04 | 0.39***  | 0.04 | 0.50***                | 0.05 | 0.51***  | 0.04 |
|                          | Number of books    | 0.10                | 0.06 | 0.10    | 0.06 | 0.06                     | 0.06 | 0.07    | 0.06 | 0.13**             | 0.04 | 0.15***  | 0.04 | 0.04                   | 0.04 | 0.06     | 0.04 |
|                          | Immigration status | -0.01               | 0.06 | -0.01   | 0.06 | -0.00                    | 0.06 | -0.01   | 0.06 | -0.16***           | 0.04 | -0.19*** | 0.04 | -0.13***               | 0.04 | -0.15*** | 0.04 |
| <b>Seventh grade</b>     |                    |                     |      |         |      |                          |      |         |      |                    |      |          |      |                        |      |          |      |
| <i>Personality</i>       | ES                 | 0.23***             | 0.04 | 0.15**  | 0.05 | 0.16***                  | 0.04 | 0.13**  | 0.04 | 0.23***            | 0.04 | 0.08     | 0.04 | 0.18***                | 0.03 | 0.11**   | 0.04 |
| <i>Control variables</i> | Gender             | 0.20***             | 0.04 | 0.19*** | 0.04 | 0.01                     | 0.03 | 0.01    | 0.03 | 0.04               | 0.03 | 0.04     | 0.03 | -0.14***               | 0.03 | -0.14*** | 0.03 |
|                          | IQ                 | 0.31***             | 0.04 | 0.32*** | 0.04 | 0.39***                  | 0.04 | 0.40*** | 0.04 | 0.38***            | 0.04 | 0.40***  | 0.04 | 0.50***                | 0.04 | 0.51***  | 0.04 |
|                          | Number of books    | 0.09                | 0.04 | 0.09    | 0.04 | 0.05                     | 0.04 | 0.06    | 0.04 | 0.06               | 0.03 | 0.07     | 0.03 | 0.07                   | 0.03 | 0.08     | 0.03 |
|                          | Immigration status | -0.12**             | 0.05 | -0.15** | 0.05 | -0.08                    | 0.05 | -0.10   | 0.05 | -0.23***           | 0.04 | -0.25*** | 0.04 | -0.18***               | 0.03 | -0.20*** | 0.04 |
| <b>Ninth grade</b>       |                    |                     |      |         |      |                          |      |         |      |                    |      |          |      |                        |      |          |      |
| <i>Personality</i>       | ES                 | 0.09                | 0.05 | 0.07    | 0.04 | 0.01                     | 0.05 | 0.04    | 0.04 | 0.12**             | 0.04 | 0.10**   | 0.04 | 0.12**                 | 0.04 | 0.06     | 0.03 |
| <i>Control Variables</i> | Gender             | 0.26***             | 0.03 | 0.26*** | 0.03 | -0.11**                  | 0.03 | -0.11** | 0.03 | 0.08**             | 0.03 | 0.08**   | 0.03 | -0.16***               | 0.02 | -0.16*** | 0.02 |
|                          | IQ                 | 0.13**              | 0.04 | 0.13*** | 0.04 | 0.28***                  | 0.03 | 0.27*** | 0.04 | 0.41***            | 0.03 | 0.42***  | 0.03 | 0.54***                | 0.03 | 0.55***  | 0.03 |
|                          | Number of books    | 0.05                | 0.04 | 0.06    | 0.04 | 0.04                     | 0.04 | 0.04    | 0.04 | 0.16***            | 0.03 | 0.16***  | 0.03 | 0.12***                | 0.03 | 0.13***  | 0.03 |
|                          | Immigration status | -0.07               | 0.04 | -0.08   | 0.03 | 0.01                     | 0.03 | 0.00    | 0.03 | -0.17***           | 0.03 | -0.18*** | 0.03 | -0.05                  | 0.03 | -0.06    | 0.03 |
| <b>Model fit</b>         |                    |                     |      |         |      |                          |      |         |      |                    |      |          |      |                        |      |          |      |
|                          | n                  | 2667                |      | 2667    |      | 2667                     |      | 2667    |      | 2667               |      | 2667     |      | 2667                   |      | 2667     |      |
|                          | CFI                | .96                 |      | .98     |      | .96                      |      | .98     |      | .98                |      | .99      |      | .98                    |      | .99      |      |
|                          | RMSEA              | .04                 |      | .03     |      | .04                      |      | .03     |      | .04                |      | .03      |      | .04                    |      | .03      |      |
|                          | SRMR               | .03                 |      | .02     |      | .03                      |      | .02     |      | .03                |      | .02      |      | .03                    |      | .02      |      |
| <b>Extraversion</b>      |                    |                     |      |         |      |                          |      |         |      |                    |      |          |      |                        |      |          |      |
| <b>Fifth grade</b>       |                    |                     |      |         |      |                          |      |         |      |                    |      |          |      |                        |      |          |      |
| <i>Personality</i>       | E                  | 0.06                | 0.14 | 0.02    | 0.07 | 0.02                     | 0.13 | 0.03    | 0.07 | 0.20***            | 0.05 | 0.07     | 0.03 | 0.13**                 | 0.05 | 0.05     | 0.03 |
| <i>Control variables</i> | Gender             | 0.08                | 0.07 | 0.08    | 0.07 | 0.02                     | 0.06 | 0.01    | 0.06 | 0.00               | 0.03 | 0.01     | 0.03 | -0.22***               | 0.03 | -0.22*** | 0.03 |

|                          |                    |         |      |         |      |         |      |         |      |          |      |          |      |          |      |          |      |
|--------------------------|--------------------|---------|------|---------|------|---------|------|---------|------|----------|------|----------|------|----------|------|----------|------|
|                          | IQ                 | 0.10    | 0.06 | 0.11    | 0.06 | 0.12    | 0.06 | 0.12    | 0.06 | 0.37***  | 0.04 | 0.39***  | 0.04 | 0.50***  | 0.05 | 0.52***  | 0.04 |
|                          | Number of books    | 0.10    | 0.06 | 0.10    | 0.06 | 0.07    | 0.06 | 0.07    | 0.06 | 0.14***  | 0.04 | 0.15***  | 0.04 | 0.06     | 0.04 | 0.06     | 0.04 |
|                          | Immigration status | -0.01   | 0.06 | -0.01   | 0.06 | -0.01   | 0.06 | -0.01   | 0.06 | -0.17*** | 0.04 | -0.18*** | 0.04 | -0.14*** | 0.04 | -0.15*** | 0.04 |
| <b>Seventh grade</b>     |                    |         |      |         |      |         |      |         |      |          |      |          |      |          |      |          |      |
| <i>Personality</i>       | E                  | 0.22*** | 0.04 | 0.04    | 0.05 | 0.16*** | 0.04 | 0.02    | 0.04 | 0.19***  | 0.04 | 0.07     | 0.04 | 0.14***  | 0.03 | 0.08     | 0.03 |
| <i>Control variables</i> | Gender             | 0.17*** | 0.04 | 0.19*** | 0.04 | -0.01   | 0.03 | 0.01    | 0.03 | 0.02     | 0.03 | 0.03     | 0.03 | -0.16*** | 0.03 | -0.15*** | 0.03 |
|                          | IQ                 | 0.32*** | 0.05 | 0.33*** | 0.05 | 0.40*** | 0.04 | 0.41*** | 0.04 | 0.39***  | 0.04 | 0.41***  | 0.04 | 0.51***  | 0.04 | 0.52***  | 0.04 |
|                          | Number of books    | 0.09    | 0.04 | 0.10    | 0.04 | 0.06    | 0.04 | 0.06    | 0.04 | 0.07     | 0.03 | 0.07     | 0.03 | 0.08     | 0.03 | 0.08     | 0.03 |
|                          | Immigration status | -0.12** | 0.04 | -0.14** | 0.05 | -0.08   | 0.05 | -0.09   | 0.05 | -0.23*** | 0.04 | -0.25*** | 0.04 | -0.18*** | 0.03 | -0.19*** | 0.04 |
| <b>Ninth grade</b>       |                    |         |      |         |      |         |      |         |      |          |      |          |      |          |      |          |      |
| <i>Personality</i>       | E                  | 0.01    | 0.05 | -0.03   | 0.03 | -0.08   | 0.04 | -0.07   | 0.04 | 0.02     | 0.04 | 0.02     | 0.04 | 0.01     | 0.03 | 0.01     | 0.03 |
| <i>Control variables</i> | Gender             | 0.26*** | 0.03 | 0.26*** | 0.03 | -0.10** | 0.03 | -0.10** | 0.03 | 0.08**   | 0.02 | 0.08**   | 0.02 | -0.16*** | 0.02 | -0.16*** | 0.03 |
|                          | IQ                 | 0.14*** | 0.04 | 0.14*** | 0.04 | 0.28*** | 0.03 | 0.28*** | 0.04 | 0.43***  | 0.03 | 0.43***  | 0.03 | 0.55***  | 0.03 | 0.55***  | 0.03 |
|                          | Number of books    | 0.06    | 0.04 | 0.06    | 0.04 | 0.04    | 0.05 | 0.04    | 0.04 | 0.16***  | 0.03 | 0.16***  | 0.03 | 0.13***  | 0.03 | 0.13***  | 0.03 |
|                          | Immigration status | -0.08   | 0.04 | -0.08   | 0.04 | 0.00    | 0.03 | 0.00    | 0.03 | -0.18*** | 0.03 | -0.18*** | 0.03 | -0.06    | 0.03 | -0.06    | 0.03 |
| <b>Model fit</b>         |                    |         |      |         |      |         |      |         |      |          |      |          |      |          |      |          |      |
|                          | n                  | 2667    |      | 2667    |      | 2667    |      | 2667    |      | 2667     |      | 2667     |      | 2667     |      | 2667     |      |
|                          | CFI                | .96     |      | .98     |      | .96     |      | .98     |      | .96      |      | .98      |      | .97      |      | .98      |      |
|                          | RMSEA              | .05     |      | .05     |      | .05     |      | .05     |      | .06      |      | .05      |      | .05      |      | .05      |      |
|                          | SRMR               | .02     |      | .03     |      | .02     |      | .03     |      | .03      |      | .03      |      | .03      |      | .03      |      |

| <b>Openness</b>          |                    | German school grade |      |         |      | Mathematics school grade |      |         |      | Reading competence |      |          |      | Mathematics competence |      |          |      |
|--------------------------|--------------------|---------------------|------|---------|------|--------------------------|------|---------|------|--------------------|------|----------|------|------------------------|------|----------|------|
|                          |                    | Adolescents         |      | Parents |      | Adolescents              |      | Parents |      | Adolescents        |      | Parents  |      | Adolescents            |      | Parents  |      |
|                          |                    | $\beta$             | SE   | $\beta$ | SE   | $\beta$                  | SE   | $\beta$ | SE   | $\beta$            | SE   | $\beta$  | SE   | $\beta$                | SE   | $\beta$  | SE   |
| <b>Fifth grade</b>       |                    |                     |      |         |      |                          |      |         |      |                    |      |          |      |                        |      |          |      |
| <i>Personality</i>       | O                  | 0.06                | 0.14 | 0.07    | 0.10 | 0.07                     | 0.13 | 0.09    | 0.09 | 0.30***            | 0.06 | 0.30***  | 0.05 | 0.25***                | 0.06 | 0.21***  | 0.05 |
| <i>Control variables</i> | Gender             | 0.08                | 0.07 | 0.08    | 0.07 | 0.02                     | 0.06 | 0.02    | 0.06 | 0.02               | 0.03 | 0.01     | 0.03 | -0.21***               | 0.03 | -0.21*** | 0.03 |
|                          | IQ                 | 0.10                | 0.06 | 0.09    | 0.06 | 0.10                     | 0.06 | 0.10    | 0.06 | 0.33***            | 0.05 | 0.31***  | 0.04 | 0.47***                | 0.05 | 0.47***  | 0.05 |
|                          | Number of books    | 0.09                | 0.06 | 0.09    | 0.06 | 0.06                     | 0.06 | 0.06    | 0.06 | 0.10               | 0.04 | 0.10**   | 0.04 | 0.02                   | 0.04 | 0.03     | 0.04 |
|                          | Immigration status | -0.01               | 0.06 | -0.00   | 0.06 | -0.01                    | 0.06 | -0.01   | 0.06 | -0.19***           | 0.04 | -0.16*** | 0.04 | -0.16***               | 0.04 | -0.14**  | 0.04 |
| <b>Seventh grade</b>     |                    |                     |      |         |      |                          |      |         |      |                    |      |          |      |                        |      |          |      |
| <i>Personality</i>       | O                  | 0.30***             | 0.04 | 0.22*** | 0.05 | 0.23***                  | 0.04 | 0.16**  | 0.05 | 0.29***            | 0.04 | 0.23***  | 0.05 | 0.22***                | 0.04 | 0.14***  | 0.04 |
| <i>Control variables</i> | Gender             | 0.19***             | 0.04 | 0.19*** | 0.04 | 0.01                     | 0.03 | 0.00    | 0.03 | 0.03               | 0.03 | 0.03     | 0.03 | -0.15***               | 0.03 | -0.15*** | 0.03 |
|                          | IQ                 | 0.27***             | 0.04 | 0.27*** | 0.05 | 0.36***                  | 0.04 | 0.37*** | 0.04 | 0.35***            | 0.04 | 0.35***  | 0.04 | 0.48***                | 0.04 | 0.49***  | 0.04 |

|                          |                    |                     |      |         |      |                          |      |         |      |                    |      |          |      |                        |      |          |      |
|--------------------------|--------------------|---------------------|------|---------|------|--------------------------|------|---------|------|--------------------|------|----------|------|------------------------|------|----------|------|
|                          | Number of books    | 0.07                | 0.04 | 0.07    | 0.04 | 0.04                     | 0.04 | 0.04    | 0.04 | 0.04               | 0.03 | 0.04     | 0.03 | 0.06                   | 0.03 | 0.06     | 0.03 |
|                          | Immigration status | -0.12**             | 0.05 | -0.13** | 0.05 | -0.07                    | 0.05 | -0.08   | 0.05 | -0.23***           | 0.04 | -0.24*** | 0.04 | -0.18***               | 0.03 | -0.18*** | 0.04 |
| <b>Ninth grade</b>       |                    |                     |      |         |      |                          |      |         |      |                    |      |          |      |                        |      |          |      |
| <i>Personality</i>       | O                  | 0.19**              | 0.06 | 0.13    | 0.05 | 0.10                     | 0.05 | 0.04    | 0.05 | 0.15***            | 0.04 | 0.17***  | 0.04 | 0.08                   | 0.04 | 0.12**   | 0.04 |
| <i>Control variables</i> | Gender             | 0.26***             | 0.03 | 0.25*** | 0.03 | -0.11**                  | 0.03 | -0.11** | 0.03 | 0.08**             | 0.03 | 0.07**   | 0.02 | -0.16***               | 0.02 | -0.17*** | 0.02 |
|                          | IQ                 | 0.11**              | 0.04 | 0.11**  | 0.04 | 0.26***                  | 0.03 | 0.27*** | 0.03 | 0.40***            | 0.03 | 0.39***  | 0.03 | 0.54***                | 0.03 | 0.53***  | 0.03 |
|                          | Number of books    | 0.02                | 0.04 | 0.04    | 0.04 | 0.02                     | 0.05 | 0.03    | 0.05 | 0.14***            | 0.03 | 0.13***  | 0.03 | 0.11***                | 0.03 | 0.11***  | 0.03 |
|                          | Immigration status | -0.08               | 0.04 | -0.08   | 0.03 | 0.00                     | 0.03 | 0.01    | 0.03 | -0.18***           | 0.03 | -0.18*** | 0.03 | -0.06                  | 0.03 | -0.06    | 0.03 |
| <b>Model fit</b>         |                    |                     |      |         |      |                          |      |         |      |                    |      |          |      |                        |      |          |      |
|                          | n                  | 2667                |      | 2667    |      | 2667                     |      | 2667    |      | 2667               |      | 2667     |      | 2667                   |      | 2667     |      |
|                          | CFI                | .95                 |      | .97     |      | .95                      |      | .97     |      | .97                |      | .98      |      | .98                    |      | .98      |      |
|                          | RMSEA              | .05                 |      | .05     |      | .05                      |      | .05     |      | .05                |      | .05      |      | .05                    |      | .05      |      |
|                          | SRMR               | .03                 |      | .03     |      | .03                      |      | .03     |      | .03                |      | .03      |      | .03                    |      | .03      |      |
| <b>Agreeableness</b>     |                    |                     |      |         |      |                          |      |         |      |                    |      |          |      |                        |      |          |      |
|                          |                    | German school grade |      |         |      | Mathematics school grade |      |         |      | Reading competence |      |          |      | Mathematics competence |      |          |      |
|                          |                    | Adolescents         |      | Parents |      | Adolescents              |      | Parents |      | Adolescents        |      | Parents  |      | Adolescents            |      | Parents  |      |
| <b>Fifth grade</b>       |                    | $\beta$             | SE   | $\beta$ | SE   | $\beta$                  | SE   | $\beta$ | SE   | $\beta$            | SE   | $\beta$  | SE   | $\beta$                | SE   | $\beta$  | SE   |
| <i>Personality</i>       | A                  | 0.01                | 0.11 | 0.02    | 0.08 | 0.05                     | 0.11 | 0.03    | 0.07 | 0.17**             | 0.05 | 0.11     | 0.04 | 0.10                   | 0.06 | 0.04     | 0.04 |
| <i>Control variables</i> | Gender             | 0.08                | 0.07 | 0.08    | 0.07 | 0.01                     | 0.07 | 0.01    | 0.06 | -0.02              | 0.03 | -0.00    | 0.03 | -0.23***               | 0.03 | -0.22*** | 0.03 |
|                          | IQ                 | 0.11                | 0.06 | 0.11    | 0.06 | 0.12                     | 0.06 | 0.12    | 0.06 | 0.38***            | 0.04 | 0.39***  | 0.04 | 0.51***                | 0.04 | 0.52***  | 0.04 |
|                          | Number of books    | 0.10                | 0.06 | 0.10    | 0.06 | 0.07                     | 0.06 | 0.07    | 0.06 | 0.13**             | 0.04 | 0.14***  | 0.04 | 0.06                   | 0.04 | 0.06     | 0.04 |
|                          | Immigration status | -0.01               | 0.06 | -0.01   | 0.06 | -0.01                    | 0.06 | -0.01   | 0.06 | -0.18***           | 0.04 | -0.18*** | 0.04 | -0.15***               | 0.04 | -0.15*** | 0.04 |
| <b>Seventh grade</b>     |                    |                     |      |         |      |                          |      |         |      |                    |      |          |      |                        |      |          |      |
| <i>Personality</i>       | A                  | 0.18***             | 0.05 | 0.10    | 0.05 | 0.14***                  | 0.04 | 0.05    | 0.04 | 0.13**             | 0.05 | 0.03     | 0.04 | 0.08                   | 0.03 | 0.00     | 0.03 |
| <i>Control variables</i> | Gender             | 0.16***             | 0.04 | 0.19*** | 0.04 | -0.02                    | 0.03 | 0.01    | 0.03 | 0.01               | 0.03 | 0.04     | 0.03 | -0.16***               | 0.03 | -0.14*** | 0.03 |
|                          | IQ                 | 0.32***             | 0.05 | 0.34*** | 0.05 | 0.40***                  | 0.04 | 0.41*** | 0.04 | 0.40***            | 0.04 | 0.41***  | 0.04 | 0.52***                | 0.04 | 0.52***  | 0.04 |
|                          | Number of books    | 0.08                | 0.04 | 0.09    | 0.04 | 0.05                     | 0.04 | 0.06    | 0.04 | 0.06               | 0.03 | 0.07     | 0.03 | 0.07                   | 0.03 | 0.08     | 0.03 |
|                          | Immigration status | -0.13**             | 0.05 | -0.13** | 0.05 | -0.08                    | 0.05 | -0.08   | 0.05 | -0.24***           | 0.04 | -0.25*** | 0.04 | -0.19***               | 0.04 | -0.19*** | 0.04 |
| <b>Ninth grade</b>       |                    |                     |      |         |      |                          |      |         |      |                    |      |          |      |                        |      |          |      |
| <i>Personality</i>       | A                  | 0.05                | 0.05 | -0.01   | 0.05 | 0.02                     | 0.04 | 0.01    | 0.04 | 0.04               | 0.04 | -0.02    | 0.04 | 0.06                   | 0.04 | 0.00     | 0.03 |
| <i>Control variables</i> | Gender             | 0.25***             | 0.03 | 0.26*** | 0.03 | -0.11**                  | 0.03 | -0.11** | 0.03 | 0.07**             | 0.03 | 0.08**   | 0.03 | -0.17***               | 0.03 | -0.16*** | 0.03 |
|                          | IQ                 | 0.14***             | 0.04 | 0.14*** | 0.04 | 0.28***                  | 0.04 | 0.28*** | 0.04 | 0.42***            | 0.03 | 0.43***  | 0.03 | 0.55***                | 0.03 | 0.55***  | 0.03 |
|                          | Number of books    | 0.06                | 0.04 | 0.06    | 0.04 | 0.04                     | 0.04 | 0.04    | 0.05 | 0.16***            | 0.03 | 0.17***  | 0.03 | 0.13***                | 0.03 | 0.13***  | 0.03 |

|                          |                    |                            |       |                |      |                                 |      |                |          |                           |          |                |       |                               |       |                |      |
|--------------------------|--------------------|----------------------------|-------|----------------|------|---------------------------------|------|----------------|----------|---------------------------|----------|----------------|-------|-------------------------------|-------|----------------|------|
| Immigration status       | -0.08              | 0.03                       | -0.08 | 0.04           | 0.01 | 0.03                            | 0.01 | 0.03           | -0.18*** | 0.03                      | -0.18*** | 0.03           | -0.05 | 0.03                          | -0.06 | 0.03           |      |
| <b>Model fit</b>         |                    |                            |       |                |      |                                 |      |                |          |                           |          |                |       |                               |       |                |      |
| n                        | 2667               |                            | 2667  |                | 2667 |                                 | 2667 |                | 2667     |                           | 2667     |                | 2667  |                               | 2667  |                |      |
| CFI                      | .95                |                            | .96   |                | .95  |                                 | .97  |                | .96      |                           | .98      |                | .97   |                               | .98   |                |      |
| RMSEA                    | .05                |                            | .04   |                | .05  |                                 | .04  |                | .05      |                           | .04      |                | .05   |                               | .04   |                |      |
| SRMR                     | .03                |                            | .02   |                | .03  |                                 | .02  |                | .03      |                           | .02      |                | .03   |                               | .02   |                |      |
| <b>Conscientiousness</b> |                    | <b>German school grade</b> |       |                |      | <b>Mathematics school grade</b> |      |                |          | <b>Reading competence</b> |          |                |       | <b>Mathematics competence</b> |       |                |      |
|                          |                    | <b>Adolescents</b>         |       | <b>Parents</b> |      | <b>Adolescents</b>              |      | <b>Parents</b> |          | <b>Adolescents</b>        |          | <b>Parents</b> |       | <b>Adolescents</b>            |       | <b>Parents</b> |      |
| <b>Fifth grade</b>       |                    | $\beta$                    | SE    | $\beta$        | SE   | $\beta$                         | SE   | $\beta$        | SE       | $\beta$                   | SE       | $\beta$        | SE    | $\beta$                       | SE    | $\beta$        | SE   |
| <i>Personality</i>       | C                  | 0.04                       | 0.12  | 0.07           | 0.08 | 0.06                            | 0.10 | 0.06           | 0.08     | 0.13**                    | 0.05     | 0.05           | 0.04  | 0.12**                        | 0.04  | 0.03           | 0.04 |
| <i>Control variables</i> | Gender             | 0.08                       | 0.07  | 0.07           | 0.07 | 0.01                            | 0.06 | 0.00           | 0.06     | 0.01                      | 0.03     | 0.00           | 0.03  | -0.22***                      | 0.03  | -0.22***       | 0.03 |
|                          | IQ                 | 0.11                       | 0.06  | 0.11           | 0.06 | 0.12                            | 0.06 | 0.12           | 0.06     | 0.39***                   | 0.04     | 0.39***        | 0.04  | 0.51***                       | 0.04  | 0.52***        | 0.04 |
|                          | Number of books    | 0.10                       | 0.06  | 0.10           | 0.06 | 0.07                            | 0.06 | 0.07           | 0.06     | 0.15***                   | 0.04     | 0.16***        | 0.04  | 0.06                          | 0.04  | 0.07           | 0.04 |
|                          | Immigration status | -0.01                      | 0.06  | -0.02          | 0.06 | -0.02                           | 0.06 | -0.02          | 0.06     | -0.19***                  | 0.04     | -0.19***       | 0.04  | -0.16***                      | 0.04  | -0.15***       | 0.04 |
| <b>Seventh grade</b>     |                    |                            |       |                |      |                                 |      |                |          |                           |          |                |       |                               |       |                |      |
| <i>Personality</i>       | C                  | 0.23***                    | 0.04  | 0.24***        | 0.04 | 0.17***                         | 0.04 | 0.18***        | 0.05     | 0.10***                   | 0.03     | 0.06           | 0.04  | 0.10**                        | 0.03  | 0.06           | 0.03 |
| <i>Control variables</i> | Gender             | 0.17***                    | 0.04  | 0.15***        | 0.04 | -0.01                           | 0.03 | -0.02          | 0.03     | 0.03                      | 0.03     | 0.03           | 0.03  | -0.15***                      | 0.03  | -0.15***       | 0.03 |
|                          | IQ                 | 0.31***                    | 0.05  | 0.31***        | 0.05 | 0.39***                         | 0.04 | 0.39***        | 0.04     | 0.40***                   | 0.04     | 0.40***        | 0.04  | 0.51***                       | 0.04  | 0.52***        | 0.04 |
|                          | Number of books    | 0.09                       | 0.04  | 0.10           | 0.04 | 0.05                            | 0.04 | 0.06           | 0.04     | 0.07                      | 0.03     | 0.07           | 0.03  | 0.08                          | 0.03  | 0.08           | 0.03 |
|                          | Immigration status | -0.17***                   | 0.05  | -0.16***       | 0.04 | -0.11                           | 0.05 | -0.10          | 0.05     | -0.26***                  | 0.04     | -0.25***       | 0.04  | -0.20***                      | 0.04  | -0.20***       | 0.04 |
| <b>Ninth grade</b>       |                    |                            |       |                |      |                                 |      |                |          |                           |          |                |       |                               |       |                |      |
| <i>Personality</i>       | C                  | 0.15**                     | 0.05  | 0.17***        | 0.05 | 0.14***                         | 0.04 | 0.15***        | 0.04     | 0.05                      | 0.03     | 0.01           | 0.04  | 0.07                          | 0.03  | 0.08           | 0.03 |
| <i>Control variables</i> | Gender             | 0.23***                    | 0.03  | 0.23***        | 0.03 | -0.13***                        | 0.03 | -0.13***       | 0.03     | 0.07**                    | 0.03     | 0.08**         | 0.03  | -0.17***                      | 0.02  | -0.17***       | 0.02 |
|                          | IQ                 | 0.14***                    | 0.04  | 0.14***        | 0.04 | 0.28***                         | 0.04 | 0.28***        | 0.04     | 0.43***                   | 0.03     | 0.43***        | 0.03  | 0.55***                       | 0.03  | 0.55***        | 0.03 |
|                          | Number of books    | 0.06                       | 0.04  | 0.05           | 0.04 | 0.04                            | 0.04 | 0.03           | 0.04     | 0.16***                   | 0.03     | 0.16***        | 0.03  | 0.13***                       | 0.03  | 0.13***        | 0.03 |
|                          | Immigration status | -0.09**                    | 0.03  | -0.10**        | 0.03 | -0.01                           | 0.03 | -0.02          | 0.03     | -0.18***                  | 0.03     | -0.18***       | 0.03  | -0.06                         | 0.03  | -0.07          | 0.03 |
| <b>Model fit</b>         | n                  | 2667                       |       | 2667           |      | 2667                            |      | 2667           |          | 2667                      |          | 2667           |       | 2667                          |       | 2667           |      |
|                          | CFI                | .97                        |       | .95            |      | .98                             |      | .95            |          | .98                       |          | .95            |       | .98                           |       | .96            |      |
|                          | RMSEA              | .04                        |       | .07            |      | .04                             |      | .07            |          | .04                       |          | .07            |       | .04                           |       | .08            |      |
|                          | SRMR               | .03                        |       | .03            |      | .03                             |      | .03            |          | .03                       |          | .03            |       | .03                           |       | .03            |      |

\*\*  $p < .01$ . \*\*\*  $p < .001$ .

Table OS 6

Standardized Effects of Self- and Parent-Reported Personality on the Three Social Relationship Variables in Grades 5, 7, and 9

| Emotional stability      | Fifth grade          | Helpfulness |      |         |      | Aggressiveness |      |          |      | Teacher-student relationship |      |         |      |
|--------------------------|----------------------|-------------|------|---------|------|----------------|------|----------|------|------------------------------|------|---------|------|
|                          |                      | Adolescents |      | Parents |      | Adolescents    |      | Parents  |      | Adolescents                  |      | Parents |      |
|                          |                      | $\beta$     | SE   | $\beta$ | SE   | $\beta$        | SE   | $\beta$  | SE   | $\beta$                      | SE   | $\beta$ | SE   |
| <i>Personality</i>       | ES                   | 0.22***     | 0.06 | 0.14*** | 0.04 | -0.12          | 0.05 | -0.02    | 0.04 | 0.22**                       | 0.07 | 0.10    | 0.05 |
| <i>Control variables</i> | Gender               | 0.21***     | 0.04 | 0.19*** | 0.04 | -0.39***       | 0.03 | -0.39*** | 0.03 | 0.06                         | 0.04 | 0.04    | 0.05 |
|                          | IQ                   | 0.18**      | 0.05 | 0.19*** | 0.05 | -0.18***       | 0.03 | -0.19*** | 0.03 | -0.02                        | 0.04 | -0.00   | 0.04 |
|                          | Number of books      | -0.01       | 0.05 | 0.01    | 0.04 | -0.11          | 0.04 | -0.12**  | 0.04 | 0.06                         | 0.05 | 0.08    | 0.05 |
|                          | Immigration status   | -0.04       | 0.04 | -0.06   | 0.04 | 0.04           | 0.05 | 0.05     | 0.05 | -0.02                        | 0.05 | -0.03   | 0.05 |
|                          | <b>Seventh grade</b> |             |      |         |      |                |      |          |      |                              |      |         |      |
| <i>Personality</i>       | ES                   | 0.11**      | 0.04 | 0.16*** | 0.04 | -0.05          | 0.04 | -0.06    | 0.05 | 0.19***                      | 0.04 | 0.10    | 0.04 |
| <i>Control variables</i> | Gender               | 0.12**      | 0.04 | 0.12**  | 0.04 | -0.30***       | 0.03 | -0.30*** | 0.03 | 0.05                         | 0.04 | 0.04    | 0.04 |
|                          | IQ                   | 0.06        | 0.05 | 0.06    | 0.05 | -0.08          | 0.03 | -0.08    | 0.03 | -0.08                        | 0.04 | -0.07   | 0.04 |
|                          | Number of books      | 0.01        | 0.04 | 0.01    | 0.04 | -0.12**        | 0.04 | -0.12**  | 0.04 | -0.00                        | 0.04 | 0.00    | 0.04 |
|                          | Immigration status   | 0.06        | 0.05 | 0.05    | 0.05 | 0.13**         | 0.04 | 0.13***  | 0.04 | -0.07                        | 0.04 | -0.09   | 0.04 |
|                          | <b>Ninth grade</b>   |             |      |         |      |                |      |          |      |                              |      |         |      |
| <i>Personality</i>       | ES                   | 0.10        | 0.05 | 0.17*** | 0.04 | -0.06          | 0.04 | -0.06    | 0.04 | 0.02                         | 0.04 | 0.03    | 0.05 |
| <i>Control variables</i> | Gender               | 0.13***     | 0.04 | 0.13*** | 0.03 | -0.24***       | 0.03 | -0.24*** | 0.03 | 0.02                         | 0.03 | 0.02    | 0.03 |
|                          | IQ                   | 0.11        | 0.05 | 0.10    | 0.05 | -0.10          | 0.05 | -0.10    | 0.05 | -0.00                        | 0.04 | -0.01   | 0.05 |
|                          | Number of books      | 0.02        | 0.05 | 0.03    | 0.05 | -0.07          | 0.04 | -0.08    | 0.04 | -0.05                        | 0.05 | -0.05   | 0.05 |
|                          | Immigration status   | -0.01       | 0.05 | -0.02   | 0.05 | 0.13**         | 0.04 | 0.14***  | 0.04 | -0.03                        | 0.04 | -0.03   | 0.04 |
|                          | <b>Model fit</b>     |             |      |         |      |                |      |          |      |                              |      |         |      |
|                          | n                    | 2667        |      | 2667    |      | 2667           |      | 2667     |      | 2667                         |      | 2667    |      |
|                          | CFI                  | .95         |      | .98     |      | .97            |      | .97      |      | .96                          |      | .98     |      |
|                          | RMSEA                | .04         |      | .03     |      | .04            |      | .04      |      | .04                          |      | .03     |      |
|                          | SRMR                 | .03         |      | .02     |      | .03            |      | .03      |      | .03                          |      | .02     |      |
| Extraversion             | Fifth grade          | Helpfulness |      |         |      | Aggressiveness |      |          |      | Teacher-student relationship |      |         |      |
|                          |                      | Adolescents |      | Parents |      | Adolescents    |      | Parents  |      | Adolescents                  |      | Parents |      |
|                          |                      | Beta        | SE   | Beta    | SE   | Beta           | SE   | Beta     | SE   | Beta                         | SE   | Beta    | SE   |
| <i>Personality</i>       | E                    | 0.16        | 0.06 | 0.03    | 0.05 | -0.02          | 0.05 | 0.02     | 0.04 | 0.24***                      | 0.06 | 0.04    | 0.04 |
| <i>Control variables</i> | Gender               | 0.20***     | 0.04 | 0.20*** | 0.04 | -0.39***       | 0.03 | -0.39*** | 0.03 | 0.04                         | 0.04 | 0.05    | 0.05 |



|                          |                    |         |      |         |      |          |      |          |      |         |      |        |      |
|--------------------------|--------------------|---------|------|---------|------|----------|------|----------|------|---------|------|--------|------|
|                          | IQ                 | 0.18**  | 0.05 | 0.20*** | 0.05 | -0.19*** | 0.03 | -0.19*** | 0.03 | -0.03   | 0.04 | 0.01   | 0.04 |
|                          | Number of books    | 0.00    | 0.05 | 0.01    | 0.04 | -0.12**  | 0.04 | -0.13**  | 0.04 | 0.06    | 0.05 | 0.08   | 0.05 |
|                          | Immigration status | -0.05   | 0.04 | -0.05   | 0.04 | 0.04     | 0.05 | 0.05     | 0.05 | -0.02   | 0.05 | -0.03  | 0.05 |
| <b>Seventh grade</b>     |                    |         |      |         |      |          |      |          |      |         |      |        |      |
| <i>Personality</i>       | E                  | 0.16*** | 0.04 | 0.14**  | 0.04 | -0.05    | 0.04 | 0.06     | 0.04 | 0.18*** | 0.04 | 0.12** | 0.05 |
| <i>Control variables</i> | Gender             | 0.10    | 0.04 | 0.11    | 0.05 | -0.29*** | 0.03 | -0.30*** | 0.03 | 0.02    | 0.04 | 0.03   | 0.04 |
|                          | IQ                 | 0.06    | 0.05 | 0.07    | 0.05 | -0.08    | 0.03 | -0.09**  | 0.03 | -0.07   | 0.04 | -0.06  | 0.04 |
|                          | Number of books    | 0.01    | 0.04 | 0.00    | 0.04 | -0.12**  | 0.04 | -0.12**  | 0.04 | 0.00    | 0.04 | 0.00   | 0.04 |
|                          | Immigration status | 0.07    | 0.05 | 0.05    | 0.05 | 0.13**   | 0.04 | 0.13**   | 0.04 | -0.07   | 0.04 | -0.09  | 0.04 |
| <b>Ninth grade</b>       |                    |         |      |         |      |          |      |          |      |         |      |        |      |
| <i>Personality</i>       | E                  | 0.07    | 0.04 | 0.11**  | 0.03 | 0.05     | 0.03 | 0.10     | 0.04 | 0.02    | 0.04 | 0.01   | 0.05 |
| <i>Control variables</i> | Gender             | 0.12**  | 0.04 | 0.11*** | 0.03 | -0.25*** | 0.03 | -0.26*** | 0.03 | 0.01    | 0.03 | 0.01   | 0.03 |
|                          | IQ                 | 0.11    | 0.05 | 0.12    | 0.06 | -0.11    | 0.05 | -0.11    | 0.05 | -0.00   | 0.04 | -0.00  | 0.04 |
|                          | Number of books    | 0.03    | 0.05 | 0.03    | 0.05 | -0.08    | 0.04 | -0.08    | 0.04 | -0.05   | 0.05 | -0.05  | 0.05 |
|                          | Immigration status | -0.02   | 0.05 | -0.02   | 0.05 | 0.14***  | 0.04 | 0.14***  | 0.04 | -0.03   | 0.04 | -0.03  | 0.04 |
| <b>Model fit</b>         |                    |         |      |         |      |          |      |          |      |         |      |        |      |
|                          | n                  | 2667    |      | 2667    |      | 2667     |      | 2667     |      | 2667    |      | 2667   |      |
|                          | CFI                | .95     |      | .97     |      | .96      |      | .98      |      | .95     |      | .97    |      |
|                          | RMSEA              | .05     |      | .05     |      | .05      |      | .05      |      | .05     |      | .05    |      |
|                          | SRMR               | .02     |      | .03     |      | .02      |      | .03      |      | .02     |      | .03    |      |

| <b>Openness</b>          |                    | Helpfulness |      |         |      | Aggressiveness |      |          |      | Teacher-student relationship |      |         |      |
|--------------------------|--------------------|-------------|------|---------|------|----------------|------|----------|------|------------------------------|------|---------|------|
|                          |                    | Adolescents |      | Parents |      | Adolescents    |      | Parents  |      | Adolescents                  |      | Parents |      |
|                          |                    | Beta        | SE   | Beta    | SE   | Beta           | SE   | Beta     | SE   | Beta                         | SE   | Beta    | SE   |
| <b>Fifth grade</b>       |                    |             |      |         |      |                |      |          |      |                              |      |         |      |
| <i>Personality</i>       | O                  | 0.21        | 0.08 | 0.12**  | 0.05 | -0.08          | 0.06 | -0.08    | 0.04 | 0.29***                      | 0.08 | 0.14    | 0.06 |
| <i>Control variables</i> | Gender             | 0.20***     | 0.05 | 0.21*** | 0.04 | -0.39***       | 0.03 | -0.39*** | 0.03 | 0.05                         | 0.04 | 0.05    | 0.04 |
|                          | IQ                 | 0.07        | 0.03 | 0.17**  | 0.06 | -0.18***       | 0.03 | -0.17*** | 0.04 | -0.06                        | 0.05 | -0.03   | 0.04 |
|                          | Number of books    | -0.02       | 0.04 | -0.01   | 0.04 | -0.11          | 0.04 | -0.11**  | 0.04 | 0.02                         | 0.05 | 0.06    | 0.05 |
|                          | Immigration status | -0.06       | 0.04 | -0.05   | 0.04 | 0.05           | 0.05 | 0.04     | 0.05 | -0.04                        | 0.05 | -0.02   | 0.05 |
| <b>Seventh grade</b>     |                    |             |      |         |      |                |      |          |      |                              |      |         |      |
| <i>Personality</i>       | O                  | 0.13**      | 0.04 | 0.10    | 0.05 | -0.09          | 0.05 | 0.00     | 0.05 | 0.15**                       | 0.05 | 0.13    | 0.05 |
| <i>Control variables</i> | Gender             | 0.11**      | 0.04 | 0.12**  | 0.04 | -0.30***       | 0.03 | -0.30*** | 0.03 | 0.04                         | 0.03 | 0.04    | 0.04 |
|                          | IQ                 | 0.02        | 0.02 | 0.05    | 0.05 | -0.07          | 0.03 | -0.09    | 0.03 | -0.09                        | 0.03 | -0.09   | 0.04 |
|                          | Number of books    | -0.00       | 0.03 | -0.00   | 0.04 | -0.11**        | 0.04 | -0.12**  | 0.04 | -0.01                        | 0.04 | -0.01   | 0.04 |

|                          |                    |         |      |         |      |          |      |          |      |       |      |       |      |
|--------------------------|--------------------|---------|------|---------|------|----------|------|----------|------|-------|------|-------|------|
|                          | Immigration status | 0.06    | 0.04 | 0.06    | 0.04 | 0.12**   | 0.04 | 0.13**   | 0.04 | -0.08 | 0.04 | -0.08 | 0.04 |
| <b>Ninth grade</b>       |                    |         |      |         |      |          |      |          |      |       |      |       |      |
| <i>Personality</i>       | O                  | 0.18**  | 0.07 | 0.11    | 0.05 | -0.11**  | 0.04 | -0.00    | 0.04 | 0.08  | 0.05 | 0.05  | 0.05 |
| <i>Control variables</i> | Gender             | 0.15*** | 0.04 | 0.12*** | 0.03 | -0.25*** | 0.03 | -0.24*** | 0.03 | 0.02  | 0.03 | 0.01  | 0.03 |
|                          | IQ                 | 0.06    | 0.04 | 0.09    | 0.06 | -0.09    | 0.04 | -0.11    | 0.05 | -0.02 | 0.04 | -0.01 | 0.05 |
|                          | Number of books    | 0.00    | 0.05 | 0.01    | 0.04 | -0.06    | 0.04 | -0.08    | 0.04 | -0.06 | 0.05 | -0.06 | 0.05 |
|                          | Immigration status | -0.03   | 0.06 | -0.02   | 0.05 | 0.14***  | 0.04 | 0.13***  | 0.04 | -0.03 | 0.04 | -0.03 | 0.04 |
| <b>Model fit</b>         |                    |         |      |         |      |          |      |          |      |       |      |       |      |
|                          | n                  | 2667    |      | 2667    |      | 2667     |      | 2667     |      | 2667  |      | 2667  |      |
|                          | CFI                | .94     |      | .96     |      | .95      |      | .97      |      | .93   |      | .96   |      |
|                          | RMSEA              | .05     |      | .05     |      | .05      |      | .05      |      | .05   |      | .05   |      |
|                          | SRMR               | .03     |      | .03     |      | .03      |      | .03      |      | .03   |      | .03   |      |

|                          |                    | Helpfulness |      |         |      | Aggressiveness |      |          |      | Teacher-student relationship |      |         |      |
|--------------------------|--------------------|-------------|------|---------|------|----------------|------|----------|------|------------------------------|------|---------|------|
|                          |                    | Adolescents |      | Parents |      | Adolescents    |      | Parents  |      | Adolescents                  |      | Parents |      |
|                          |                    | Beta        | SE   | Beta    | SE   | Beta           | SE   | Beta     | SE   | Beta                         | SE   | Beta    | SE   |
| <b>Agreeableness</b>     |                    |             |      |         |      |                |      |          |      |                              |      |         |      |
| <b>Fifth grade</b>       |                    |             |      |         |      |                |      |          |      |                              |      |         |      |
| <i>Personality</i>       | A                  | 0.23***     | 0.05 | 0.13**  | 0.05 | -0.17***       | 0.05 | -0.20*** | 0.04 | 0.25***                      | 0.07 | 0.07    | 0.05 |
| <i>Control variables</i> | Gender             | 0.16***     | 0.05 | 0.19*** | 0.04 | -0.36***       | 0.04 | -0.36*** | 0.03 | 0.01                         | 0.04 | 0.04    | 0.05 |
|                          | IQ                 | 0.19***     | 0.05 | 0.19*** | 0.05 | -0.18***       | 0.03 | -0.18*** | 0.03 | -0.01                        | 0.04 | 0.00    | 0.04 |
|                          | Number of books    | -0.02       | 0.05 | -0.00   | 0.04 | -0.10          | 0.04 | -0.10    | 0.04 | 0.05                         | 0.05 | 0.07    | 0.05 |
|                          | Immigration status | -0.05       | 0.04 | -0.05   | 0.04 | 0.04           | 0.05 | 0.04     | 0.05 | -0.03                        | 0.05 | -0.03   | 0.05 |
| <b>Seventh grade</b>     |                    |             |      |         |      |                |      |          |      |                              |      |         |      |
| <i>Personality</i>       | A                  | 0.18**      | 0.05 | 0.09    | 0.05 | -0.17***       | 0.05 | -0.16*** | 0.04 | 0.24***                      | 0.05 | 0.17**  | 0.05 |
| <i>Control variables</i> | Gender             | 0.08        | 0.04 | 0.12**  | 0.05 | -0.26***       | 0.03 | -0.30*** | 0.03 | -0.01                        | 0.04 | 0.04    | 0.04 |
|                          | IQ                 | 0.06        | 0.05 | 0.08    | 0.05 | -0.08          | 0.03 | -0.09**  | 0.03 | -0.07                        | 0.03 | -0.05   | 0.04 |
|                          | Number of books    | -0.01       | 0.04 | 0.00    | 0.04 | -0.10**        | 0.04 | -0.10**  | 0.04 | -0.02                        | 0.04 | -0.01   | 0.04 |
|                          | Immigration status | 0.07        | 0.05 | 0.06    | 0.05 | 0.12**         | 0.04 | 0.11**   | 0.04 | -0.07                        | 0.04 | -0.07   | 0.04 |
| <b>Ninth grade</b>       |                    |             |      |         |      |                |      |          |      |                              |      |         |      |
| <i>Personality</i>       | A                  | 0.12        | 0.05 | 0.15*** | 0.04 | -0.22***       | 0.04 | -0.14**  | 0.04 | 0.19***                      | 0.05 | 0.12    | 0.05 |
| <i>Control variables</i> | Gender             | 0.10        | 0.04 | 0.13*** | 0.04 | -0.20***       | 0.04 | -0.25*** | 0.03 | -0.03                        | 0.04 | 0.01    | 0.03 |
|                          | IQ                 | 0.11        | 0.05 | 0.11    | 0.06 | -0.09          | 0.04 | -0.10    | 0.05 | -0.02                        | 0.04 | -0.01   | 0.04 |
|                          | Number of books    | 0.02        | 0.05 | 0.02    | 0.05 | -0.06          | 0.04 | -0.07    | 0.04 | -0.06                        | 0.05 | -0.06   | 0.05 |
|                          | Immigration status | -0.02       | 0.05 | -0.01   | 0.05 | 0.13**         | 0.04 | 0.13**   | 0.04 | -0.02                        | 0.04 | -0.02   | 0.04 |
| <b>Model fit</b>         |                    |             |      |         |      |                |      |          |      |                              |      |         |      |

|                          | n                  | 2667        | 2667 | 2667    | 2667 | 2667           | 2667 | 2667     | 2667 | 2667                         | 2667 | 2667    |      |
|--------------------------|--------------------|-------------|------|---------|------|----------------|------|----------|------|------------------------------|------|---------|------|
|                          | CFI                | .93         | .95  | .95     | .95  | .96            | .95  | .96      | .95  | .95                          | .96  | .96     |      |
|                          | RMSEA              | .05         | .05  | .05     | .05  | .05            | .05  | .05      | .05  | .05                          | .04  | .04     |      |
|                          | SRMR               | .03         | .02  | .03     | .03  | .02            | .02  | .02      | .02  | .02                          | .02  | .02     |      |
|                          |                    | Helpfulness |      |         |      | Aggressiveness |      |          |      | Teacher-student relationship |      |         |      |
| <b>Conscientiousness</b> |                    | Adolescents |      | Parents |      | Adolescents    |      | Parents  |      | Adolescents                  |      | Parents |      |
| <b>Fifth grade</b>       |                    | Beta        | SE   | Beta    | SE   | Beta           | SE   | Beta     | SE   | Beta                         | SE   | Beta    | SE   |
| <i>Personality</i>       | C                  | 0.14        | 0.06 | 0.20*** | 0.05 | -0.13          | 0.05 | -0.16*** | 0.04 | 0.20**                       | 0.06 | 0.12    | 0.05 |
| <i>Control variables</i> | Gender             | 0.20***     | 0.04 | 0.16*** | 0.04 | -0.38***       | 0.03 | -0.36*** | 0.04 | 0.04                         | 0.04 | 0.03    | 0.05 |
|                          | IQ                 | 0.19***     | 0.05 | 0.19*** | 0.05 | -0.19***       | 0.03 | -0.19*** | 0.03 | -0.01                        | 0.04 | -0.00   | 0.04 |
|                          | Number of books    | 0.01        | 0.05 | 0.01    | 0.04 | -0.12**        | 0.04 | -0.12**  | 0.04 | 0.07                         | 0.05 | 0.08    | 0.05 |
|                          | Immigration status | -0.06       | 0.04 | -0.07   | 0.04 | 0.05           | 0.05 | 0.06     | 0.05 | -0.04                        | 0.05 | -0.04   | 0.05 |
| <b>Seventh grade</b>     |                    |             |      |         |      |                |      |          |      |                              |      |         |      |
| <i>Personality</i>       | C                  | 0.14**      | 0.05 | 0.09    | 0.05 | -0.11**        | 0.04 | -0.17*** | 0.04 | 0.14**                       | 0.04 | 0.18*** | 0.04 |
| <i>Control variables</i> | Gender             | 0.11        | 0.04 | 0.10    | 0.04 | -0.29***       | 0.03 | -0.27*** | 0.03 | 0.03                         | 0.04 | 0.01    | 0.04 |
|                          | IQ                 | 0.06        | 0.05 | 0.07    | 0.05 | -0.08          | 0.03 | -0.07    | 0.03 | -0.07                        | 0.03 | -0.07   | 0.04 |
|                          | Number of books    | 0.01        | 0.04 | 0.01    | 0.04 | -0.11**        | 0.04 | -0.12**  | 0.04 | 0.00                         | 0.04 | 0.01    | 0.04 |
|                          | Immigration status | 0.04        | 0.05 | 0.05    | 0.05 | 0.14***        | 0.04 | 0.14***  | 0.04 | -0.10**                      | 0.04 | -0.10** | 0.04 |
| <b>Ninth grade</b>       |                    |             |      |         |      |                |      |          |      |                              |      |         |      |
| <i>Personality</i>       | C                  | 0.17***     | 0.04 | 0.16**  | 0.05 | -0.11**        | 0.04 | -0.11**  | 0.04 | 0.12**                       | 0.05 | 0.15**  | 0.05 |
| <i>Control variables</i> | Gender             | 0.10**      | 0.03 | 0.10**  | 0.03 | -0.23***       | 0.03 | -0.23*** | 0.03 | -0.00                        | 0.04 | -0.01   | 0.03 |
|                          | IQ                 | 0.12        | 0.06 | 0.12    | 0.06 | -0.11          | 0.05 | -0.11    | 0.05 | -0.00                        | 0.04 | -0.00   | 0.04 |
|                          | Number of books    | 0.03        | 0.04 | 0.02    | 0.04 | -0.08          | 0.04 | -0.08    | 0.04 | -0.05                        | 0.05 | -0.05   | 0.05 |
|                          | Immigration status | -0.03       | 0.05 | -0.04   | 0.05 | 0.14***        | 0.04 | 0.15***  | 0.04 | -0.04                        | 0.04 | -0.05   | 0.04 |
| <b>Model fit</b>         |                    |             |      |         |      |                |      |          |      |                              |      |         |      |
|                          | n                  | 2667        | 2667 | 2667    | 2667 | 2667           | 2667 | 2667     | 2667 | 2667                         | 2667 | 2667    |      |
|                          | CFI                | .96         | .94  | .98     | .98  | .95            | .95  | .97      | .97  | .95                          | .95  | .95     |      |
|                          | RMSEA              | .04         | .07  | .04     | .04  | .07            | .07  | .04      | .04  | .04                          | .07  | .07     |      |
|                          | SRMR               | .03         | .03  | .03     | .03  | .03            | .03  | .03      | .03  | .03                          | .03  | .03     |      |

\*\*  $p < .01$ . \*\*\*  $p < .001$ .

**Table OS 7**  
Standardized Effects of Self- and Parent-Reported Personality on the Three Adjustment Variables in Grades 5, 7, and 9

| Emotional stability      |                    | Self-esteem |      |         |      | Well-being in school |      |         |      | Health problems |      |          |      |
|--------------------------|--------------------|-------------|------|---------|------|----------------------|------|---------|------|-----------------|------|----------|------|
|                          |                    | Adolescents |      | Parents |      | Adolescents          |      | Parents |      | Adolescents     |      | Parents  |      |
|                          |                    | Beta        | SE   | Beta    | SE   | Beta                 | SE   | Beta    | SE   | Beta            | SE   | Beta     | SE   |
| <b>Fifth grade</b>       |                    |             |      |         |      |                      |      |         |      |                 |      |          |      |
| <i>Personality</i>       | ES                 | 0.51***     | 0.06 | 0.10    | 0.07 | 0.35***              | 0.07 | 0.16**  | 0.05 | -0.05           | 0.07 | -0.18*** | 0.04 |
| <i>Control variables</i> | Gender             | 0.02        | 0.04 | -0.00   | 0.04 | 0.05                 | 0.04 | 0.02    | 0.04 | -0.00           | 0.04 | 0.02     | 0.04 |
|                          | IQ                 | 0.03        | 0.05 | 0.08    | 0.05 | 0.05                 | 0.05 | 0.08    | 0.04 | -0.04           | 0.04 | -0.04    | 0.04 |
|                          | Number of books    | -0.00       | 0.05 | 0.05    | 0.04 | 0.03                 | 0.05 | 0.06    | 0.05 | -0.03           | 0.05 | -0.02    | 0.05 |
|                          | Immigration status | -0.02       | 0.05 | -0.06   | 0.04 | 0.00                 | 0.05 | -0.03   | 0.05 | 0.04            | 0.04 | 0.05     | 0.04 |
| <b>Seventh grade</b>     |                    |             |      |         |      |                      |      |         |      |                 |      |          |      |
| <i>Personality</i>       | ES                 | 0.53***     | 0.04 | 0.22*** | 0.05 | 0.33***              | 0.04 | 0.24*** | 0.05 | -0.19***        | 0.05 | -0.32*** | 0.04 |
| <i>Control variables</i> | Gender             | -0.01       | 0.03 | -0.02   | 0.04 | 0.04                 | 0.03 | 0.04    | 0.03 | -0.02           | 0.04 | -0.02    | 0.04 |
|                          | IQ                 | 0.03        | 0.04 | 0.07    | 0.05 | -0.00                | 0.04 | 0.01    | 0.04 | -0.03           | 0.04 | -0.02    | 0.04 |
|                          | Number of books    | 0.06        | 0.03 | 0.07    | 0.04 | -0.04                | 0.04 | -0.03   | 0.04 | -0.04           | 0.04 | -0.04    | 0.04 |
|                          | Immigration status | 0.05        | 0.04 | -0.00   | 0.04 | 0.05                 | 0.04 | 0.01    | 0.04 | 0.04            | 0.04 | 0.07     | 0.04 |
| <b>Ninth grade</b>       |                    |             |      |         |      |                      |      |         |      |                 |      |          |      |
| <i>Personality</i>       | ES                 | 0.47***     | 0.04 | 0.21*** | 0.05 | 0.28***              | 0.04 | 0.14**  | 0.05 | -0.11           | 0.06 | -0.18*** | 0.04 |
| <i>Control variables</i> | Gender             | -0.06       | 0.03 | -0.06   | 0.04 | 0.02                 | 0.04 | 0.02    | 0.04 | 0.10**          | 0.04 | 0.10**   | 0.04 |
|                          | IQ                 | 0.00        | 0.04 | 0.03    | 0.05 | -0.04                | 0.04 | -0.03   | 0.04 | -0.07           | 0.04 | -0.06    | 0.04 |
|                          | Number of books    | -0.02       | 0.04 | 0.02    | 0.04 | -0.04                | 0.04 | -0.03   | 0.04 | -0.02           | 0.04 | -0.03    | 0.04 |
|                          | Immigration status | 0.07        | 0.04 | 0.04    | 0.04 | 0.11***              | 0.03 | 0.08**  | 0.03 | 0.12**          | 0.04 | 0.13**   | 0.04 |
| <b>Model fit</b>         |                    |             |      |         |      |                      |      |         |      |                 |      |          |      |
|                          | n                  | 2667        |      | 2667    |      | 2667                 |      | 2667    |      | 2667            |      | 2667     |      |
|                          | CFI                | .97         |      | .98     |      | .96                  |      | .98     |      | .95             |      | .97      |      |
|                          | RMSEA              | .04         |      | .03     |      | .04                  |      | .04     |      | .04             |      | .04      |      |
|                          | SRMR               | .03         |      | .02     |      | .03                  |      | .02     |      | .03             |      | .03      |      |
| Extraversion             |                    | Self-esteem |      |         |      | Well-being in school |      |         |      | Health problems |      |          |      |
|                          |                    | Adolescents |      | Parents |      | Adolescents          |      | Parents |      | Adolescents     |      | Parents  |      |
|                          |                    | Beta        | SE   | Beta    | SE   | Beta                 | SE   | Beta    | SE   | Beta            | SE   | Beta     | SE   |
| <i>Personality</i>       | E                  | 0.42***     | 0.06 | 0.08    | 0.06 | 0.29***              | 0.06 | 0.12    | 0.05 | -0.05           | 0.06 | -0.09    | 0.04 |
| <i>Control variables</i> | Gender             | -0.02       | 0.04 | 0.00    | 0.04 | 0.02                 | 0.04 | 0.03    | 0.05 | 0.00            | 0.04 | 0.01     | 0.04 |

|                          |                    |         |      |        |      |         |      |         |      |        |      |          |      |
|--------------------------|--------------------|---------|------|--------|------|---------|------|---------|------|--------|------|----------|------|
|                          | IQ                 | 0.03    | 0.05 | 0.08   | 0.05 | 0.05    | 0.04 | 0.09    | 0.04 | -0.04  | 0.04 | -0.05    | 0.04 |
|                          | Number of books    | 0.01    | 0.05 | 0.05   | 0.04 | 0.04    | 0.05 | 0.05    | 0.05 | -0.03  | 0.05 | -0.02    | 0.05 |
|                          | Immigration status | -0.04   | 0.04 | -0.05  | 0.04 | -0.01   | 0.05 | -0.02   | 0.05 | 0.04   | 0.04 | 0.05     | 0.04 |
| <b>Seventh grade</b>     |                    |         |      |        |      |         |      |         |      |        |      |          |      |
| <i>Personality</i>       | E                  | 0.41*** | 0.03 | 0.15** | 0.05 | 0.39*** | 0.04 | 0.17*** | 0.05 | -0.10  | 0.05 | -0.22*** | 0.04 |
| <i>Control variables</i> | Gender             | -0.07   | 0.04 | -0.03  | 0.04 | -0.01   | 0.03 | 0.02    | 0.03 | 0.00   | 0.04 | 0.00     | 0.04 |
|                          | IQ                 | 0.07    | 0.04 | 0.09   | 0.05 | 0.01    | 0.04 | 0.04    | 0.05 | -0.04  | 0.04 | -0.05    | 0.04 |
|                          | Number of books    | 0.07    | 0.03 | 0.06   | 0.04 | -0.03   | 0.04 | -0.04   | 0.04 | -0.05  | 0.04 | -0.04    | 0.04 |
|                          | Immigration status | 0.04    | 0.03 | 0.01   | 0.04 | 0.05    | 0.04 | 0.01    | 0.04 | 0.05   | 0.04 | 0.06     | 0.04 |
| <b>Ninth grade</b>       |                    |         |      |        |      |         |      |         |      |        |      |          |      |
| <i>Personality</i>       | E                  | 0.30*** | 0.04 | 0.12   | 0.05 | 0.32*** | 0.04 | 0.17*** | 0.04 | -0.06  | 0.05 | -0.10    | 0.04 |
| <i>Control variables</i> | Gender             | -0.11** | 0.04 | -0.07  | 0.04 | -0.03   | 0.04 | 0.00    | 0.04 | 0.11** | 0.04 | 0.11**   | 0.04 |
|                          | IQ                 | 0.03    | 0.05 | 0.05   | 0.04 | -0.03   | 0.04 | -0.01   | 0.04 | -0.08  | 0.04 | -0.08    | 0.04 |
|                          | Number of books    | 0.01    | 0.04 | 0.02   | 0.04 | -0.03   | 0.04 | -0.02   | 0.04 | -0.03  | 0.04 | -0.03    | 0.04 |
|                          | Immigration status | 0.05    | 0.04 | 0.04   | 0.04 | 0.10**  | 0.03 | 0.09**  | 0.03 | 0.12** | 0.04 | 0.12**   | 0.04 |
| <b>Model fit</b>         |                    |         |      |        |      |         |      |         |      |        |      |          |      |
|                          | n                  | 2667    |      | 2667   |      | 2667    |      | 2667    |      | 2667   |      | 2667     |      |
|                          | CFI                | .96     |      | .97    |      | .95     |      | .97     |      | .95    |      | .97      |      |
|                          | RMSEA              | .05     |      | .05    |      | .06     |      | .05     |      | .05    |      | .05      |      |
|                          | SRMR               | .02     |      | .03    |      | .03     |      | .03     |      | .02    |      | .03      |      |

| <b>Openness</b>          | <b>Fifth grade</b> | Self-esteem |      |         |      | Well-being in school |      |         |      | Health problems |      |          |      |
|--------------------------|--------------------|-------------|------|---------|------|----------------------|------|---------|------|-----------------|------|----------|------|
|                          |                    | Adolescents |      | Parents |      | Adolescents          |      | Parents |      | Adolescents     |      | Parents  |      |
|                          |                    | Beta        | SE   | Beta    | SE   | Beta                 | SE   | Beta    | SE   | Beta            | SE   | Beta     | SE   |
| <i>Personality</i>       | O                  | 0.45***     | 0.07 | 0.13    | 0.07 | 0.30***              | 0.07 | 0.13    | 0.06 | 0.00            | 0.07 | -0.17*** | 0.05 |
| <i>Control variables</i> | Gender             | 0.02        | 0.05 | 0.01    | 0.04 | 0.04                 | 0.05 | 0.04    | 0.04 | -0.00           | 0.04 | -0.00    | 0.04 |
|                          | IQ                 | -0.02       | 0.06 | 0.05    | 0.05 | 0.02                 | 0.05 | 0.05    | 0.05 | -0.05           | 0.04 | 0.00     | 0.04 |
|                          | Number of books    | -0.04       | 0.04 | 0.03    | 0.04 | 0.01                 | 0.05 | 0.04    | 0.05 | -0.03           | 0.05 | 0.00     | 0.05 |
|                          | Immigration status | -0.07       | 0.04 | -0.05   | 0.04 | -0.03                | 0.05 | -0.01   | 0.05 | 0.05            | 0.04 | 0.04     | 0.04 |
| <b>Seventh grade</b>     |                    |             |      |         |      |                      |      |         |      |                 |      |          |      |
| <i>Personality</i>       | O                  | 0.42***     | 0.05 | 0.20*** | 0.06 | 0.23***              | 0.05 | 0.12    | 0.06 | -0.09           | 0.05 | -0.19*** | 0.05 |
| <i>Control variables</i> | Gender             | -0.03       | 0.04 | -0.03   | 0.04 | 0.03                 | 0.03 | 0.03    | 0.03 | -0.01           | 0.04 | -0.01    | 0.04 |
|                          | IQ                 | 0.01        | 0.04 | 0.04    | 0.05 | -0.01                | 0.05 | 0.01    | 0.05 | -0.03           | 0.04 | 0.00     | 0.04 |
|                          | Number of books    | 0.04        | 0.03 | 0.04    | 0.04 | -0.05                | 0.05 | -0.05   | 0.05 | -0.04           | 0.04 | -0.03    | 0.04 |



|                          | n                  | 2667                 | 2667 | 2667    | 2667 | 2667                 | 2667 | 2667    | 2667 | 2667            | 2667 | 2667     |      |
|--------------------------|--------------------|----------------------|------|---------|------|----------------------|------|---------|------|-----------------|------|----------|------|
|                          | CFI                | .95                  | .96  | .94     | .95  | .94                  | .95  | .94     | .96  | .94             | .96  | .96      |      |
|                          | RMSEA              | .05                  | .04  | .05     | .05  | .05                  | .05  | .05     | .04  | .05             | .04  | .04      |      |
|                          | SRMR               | .03                  | .02  | .03     | .03  | .03                  | .03  | .02     | .02  | .02             | .02  | .02      |      |
|                          |                    | Self-esteem          |      |         |      | Well-being in school |      |         |      | Health problems |      |          |      |
| <b>Conscientiousness</b> |                    | Adolescents          |      | Parents |      | Adolescents          |      | Parents |      | Adolescents     |      | Parents  |      |
| <b>Fifth grade</b>       |                    | Beta                 | SE   | Beta    | SE   | Beta                 | SE   | Beta    | SE   | Beta            | SE   | Beta     | SE   |
| <i>Personality</i>       | C                  | 0.40***              | 0.05 | 0.19**  | 0.06 | 0.20**               | 0.07 | 0.20*** | 0.05 | -0.11           | 0.06 | -0.21*** | 0.04 |
| <i>Control variables</i> | Gender             | -0.02                | 0.05 | -0.03   | 0.04 | 0.03                 | 0.05 | -0.00   | 0.05 | 0.00            | 0.04 | 0.04     | 0.04 |
|                          | IQ                 | 0.06                 | 0.05 | 0.07    | 0.05 | 0.08                 | 0.04 | 0.08    | 0.04 | -0.04           | 0.04 | -0.04    | 0.04 |
|                          | Number of books    | 0.03                 | 0.04 | 0.05    | 0.04 | 0.05                 | 0.05 | 0.06    | 0.05 | -0.02           | 0.05 | -0.03    | 0.05 |
|                          | Immigration status | -0.08                | 0.04 | -0.07   | 0.04 | -0.04                | 0.05 | -0.04   | 0.05 | 0.05            | 0.04 | 0.07     | 0.04 |
|                          |                    | <b>Seventh grade</b> |      |         |      |                      |      |         |      |                 |      |          |      |
| <i>Personality</i>       | C                  | 0.38***              | 0.04 | 0.20*** | 0.05 | 0.26***              | 0.04 | 0.22*** | 0.05 | -0.10           | 0.04 | -0.14*** | 0.04 |
| <i>Control variables</i> | Gender             | -0.06                | 0.04 | -0.06   | 0.04 | 0.01                 | 0.03 | -0.00   | 0.03 | 0.00            | 0.04 | 0.01     | 0.04 |
|                          | IQ                 | 0.06                 | 0.04 | 0.08    | 0.05 | 0.01                 | 0.04 | 0.02    | 0.04 | -0.04           | 0.04 | -0.04    | 0.04 |
|                          | Number of books    | 0.06                 | 0.03 | 0.08    | 0.04 | -0.04                | 0.04 | -0.02   | 0.04 | -0.05           | 0.04 | -0.06    | 0.04 |
|                          | Immigration status | -0.03                | 0.04 | -0.00   | 0.04 | -0.01                | 0.04 | 0.00    | 0.04 | 0.06            | 0.04 | 0.06     | 0.04 |
|                          |                    | <b>Ninth grade</b>   |      |         |      |                      |      |         |      |                 |      |          |      |
| <i>Personality</i>       | C                  | 0.30***              | 0.04 | 0.15**  | 0.06 | 0.15***              | 0.04 | 0.10    | 0.05 | -0.08           | 0.05 | -0.16*** | 0.04 |
| <i>Control variables</i> | Gender             | -0.10**              | 0.04 | -0.08   | 0.04 | -0.00                | 0.04 | 0.01    | 0.04 | 0.11**          | 0.04 | 0.13**   | 0.04 |
|                          | IQ                 | 0.05                 | 0.04 | 0.05    | 0.04 | -0.01                | 0.04 | -0.01   | 0.04 | -0.08           | 0.04 | -0.08    | 0.04 |
|                          | Number of books    | 0.02                 | 0.04 | 0.01    | 0.04 | -0.02                | 0.04 | -0.03   | 0.04 | -0.03           | 0.04 | -0.03    | 0.04 |
|                          | Immigration status | 0.02                 | 0.04 | 0.02    | 0.04 | 0.07                 | 0.03 | 0.07    | 0.03 | 0.13**          | 0.04 | 0.15***  | 0.04 |
|                          |                    | <b>Model fit</b>     |      |         |      |                      |      |         |      |                 |      |          |      |
|                          | n                  | 2667                 | 2667 | 2667    | 2667 | 2667                 | 2667 | 2667    | 2667 | 2667            | 2667 | 2667     |      |
|                          | CFI                | .97                  | .95  | .97     | .94  | .96                  | .95  | .96     | .95  | .96             | .95  | .95      |      |
|                          | RMSEA              | .04                  | .07  | .04     | .07  | .04                  | .07  | .04     | .07  | .04             | .07  | .07      |      |
|                          | SRMR               | .03                  | .03  | .03     | .03  | .03                  | .03  | .03     | .03  | .03             | .03  | .03      |      |

\*\* p < .01. \*\*\* p < .001.

**Table OS 8***Hypotheses, Evaluation, and Results*

| <b>Hypotheses</b>                              |  | <b>Evaluation and main results</b>  |
|--|--|---|
| <i>Personality and academic achievement</i>    |  |   |
| H1a  | Being highly conscientious will be related to better school grades.  | full support across grades and raters   |
| H1b  | Higher levels of openness will be associated with better achievement test scores.  | support across grades and raters, except for self-rated O and mathematics achievement test in 9th grade   |
| Exploratory                                    | Due to mixed findings, we do not formulate hypotheses for the other three traits.  | positive associations between self- and parent-rated ES & O and self-rated E & A with school grades in 7th grade<br><br>positive associations between self- and parent-rated ES and self-rated E, A, & C with achievement tests, not coherent across grades   |
| <i>Personality and social relationships</i>    |  |   |
| H2a  | Higher levels of agreeableness and conscientiousness will be associated with peer perceptions of more helpfulness.                               | support across two grades and partly across raters  |
| H2b  | Higher levels of emotional stability, agreeableness, and conscientiousness will be associated with peer perceptions of lower aggressiveness.     | support for A & C (not ES) across grades and raters, except for self-rated C in 5th grade   |
| H2c  | Higher levels of emotional stability, agreeableness, and conscientiousness will be associated with a more positive teacher-student relationship. | support for A & C across grades for self-ratings and partly across raters; support for ES only for self-ratings in 5th and 7th grade  |
| Exploratory                                    | Due to mixed findings, we do not formulate hypotheses for the other two traits.  | positive associations between self- and parent-rated ES, E, & O with helpfulness, not coherent across grades<br><br>negative association between self-rated O and aggressiveness in 9th grade<br>positive associations between self- and parent-rated E and self-rated O with teacher-student relationship, not coherent across grades and raters |
| <i>Personality and psychosocial adjustment</i> |  |   |
| H3a  | Higher levels of emotional stability and extraversion will be related to higher self-esteem.   | support across grades and partly across raters  |
| H3b  | Higher levels of emotional stability, extraversion, and conscientiousness will be related to greater overall well-being in school.               | support across grades and partly across raters  |
| H3c  | Higher levels of emotional stability and conscientiousness will be related to fewer parent-rated health problems.                                | support for ES in 9th grade across raters, support for parent-rated ES and C across grades  |



|                          |  |   |
|--------------------------|--|---|
| Exploratory              | Due to mixed findings, we do not formulate hypotheses for the other two traits.  | positive associations between self-rated O, A, and C with self-esteem across grades, partly congruent across raters   |
|                          |  | positive associations between self-rated O & A with well-being in school across grades, one congruent effect across raters with A in 7th grade  |
|                          |  | negative associations between parent-rated E, O, and A with health problems, only A coherent across grades  |
| <i>Age differences</i>   |  |   |
| Exploratory              | Due to scarce previous research, we tested for differences in associations between Grades 5, 7, and 9 in an exploratory fashion.                   | age differences with respect to self-rated E: higher positive associations with all achievement indicators, teacher-student relationship, and self-esteem in younger compared to older age groups |
|                          |  | age differences with respect to self-rated ES: higher positive associations with reading achievement test and teacher-student relationship in younger compared to older age groups                |
|                          |  | age differences with respect to self-rated O: higher positive associations with mathematics achievement in younger compared to older age groups   |
|                          |  | age differences with respect to parent-rated ES and E: lower negative associations with parent-rated health problems in younger compared to older age groups                                      |
| <i>Rater differences</i> |  |   |
| H4a                      | There is more similarity between self- and parent ratings for extraversion and thus, more congruent associations with extraversion.                | no support  |
| H4b                      | There is lower similarity between self- and parent ratings for emotional stability and thus, less congruent associations with emotional stability. | partly supported  |
| Exploratory              | Due to scarce evidence for personality associations from different perspectives in adolescence, we considered the remaining tests exploratory.     | rater differences with respect to ES: higher positive associations with reading achievement tests, self-esteem, and well-being in school in self-ratings of personality                           |
|                          |  | rater differences with respect to E: higher positive associations with school grades, teacher-student relationships, self-esteem, and well-being in school in self-ratings of personality         |
|                          |  | rater differences with respect to O, A, and C: higher positive associations with self-esteem in self-ratings of personality   |

*Note.* ES = Emotional stability, E = Extraversion, O = Openness, A = Agreeableness, C = Conscientiousness.

**Table OS 9**

Unstandardized interaction coefficient between student rated personality and immigration status with academic achievement

|                                | German school grade |      |          | Math school grade |      |          | Reading competence |      |          | Math competence |      |          |
|--------------------------------|---------------------|------|----------|-------------------|------|----------|--------------------|------|----------|-----------------|------|----------|
|                                | <i>b</i>            | SE   | <i>p</i> | <i>b</i>          | SE   | <i>p</i> | <i>b</i>           | SE   | <i>p</i> | <i>b</i>        | SE   | <i>p</i> |
| <i>ES × immigration status</i> |                     |      |          |                   |      |          |                    |      |          |                 |      |          |
| 5th grade                      | -0.14               | 0.38 | .742     | 0.01              | 0.41 | .985     | -0.32              | 7.12 | .964     | 0.40            | 7.63 | .958     |
| 7th grade                      | -0.23               | 0.15 | .128     | -0.18             | 0.15 | .220     | -2.48              | 3.54 | .483     | 0.35            | 3.63 | .923     |
| 9th grade                      | -0.03               | 0.15 | .871     | -0.10             | 0.17 | .563     | 2.66               | 3.62 | .463     | -5.44           | 3.20 | .089     |
| <i>E × immigration status</i>  |                     |      |          |                   |      |          |                    |      |          |                 |      |          |
| 5th grade                      | -0.17               | 0.31 | .586     | -0.22             | 0.34 | .531     | 3.60               | 5.35 | .501     | 0.68            | 5.17 | .895     |
| 7th grade                      | -0.04               | 0.12 | .767     | -0.07             | 0.14 | .607     | 1.07               | 3.08 | .728     | 2.00            | 3.05 | .512     |
| 9th grade                      | -0.15               | 0.10 | .127     | 0.00              | 0.12 | .997     | 3.77               | 2.61 | .149     | -2.72           | 2.49 | .274     |
| <i>O × immigration status</i>  |                     |      |          |                   |      |          |                    |      |          |                 |      |          |
| 5th grade                      | -0.06               | 0.37 | .874     | 0.01              | 0.41 | .979     | 3.82               | 6.34 | .547     | 3.24            | 7.86 | .680     |
| 7th grade                      | -0.12               | 0.19 | .523     | -0.04             | 0.18 | .806     | -5.49              | 4.00 | .170     | 1.05            | 3.87 | .787     |
| 9th grade                      | -0.26               | 0.16 | .112     | -0.31             | 0.18 | .086     | -2.15              | 3.52 | .541     | -5.28           | 3.45 | .126     |
| <i>A × immigration status</i>  |                     |      |          |                   |      |          |                    |      |          |                 |      |          |
| 5th grade                      | -0.10               | 0.32 | .750     | -0.12             | 0.36 | .735     | -2.84              | 6.51 | .662     | -1.53           | 6.42 | .811     |
| 7th grade                      | -0.13               | 0.16 | .404     | -0.11             | 0.17 | .519     | -5.11              | 3.60 | .156     | 1.59            | 3.69 | .667     |
| 9th grade                      | -0.22               | 0.16 | .167     | 0.06              | 0.19 | .744     | -2.68              | 3.94 | .497     | -0.47           | 3.23 | .884     |
| <i>C × immigration status</i>  |                     |      |          |                   |      |          |                    |      |          |                 |      |          |
| 5th grade                      | -0.13               | 0.27 | .642     | -0.22             | 0.34 | .526     | 4.50               | 4.82 | .351     | 0.64            | 5.31 | .904     |
| 7th grade                      | -0.21               | 0.15 | .164     | -0.10             | 0.14 | .474     | -2.49              | 2.95 | .399     | -0.09           | 3.16 | .977     |
| 9th grade                      | <b>-0.33**</b>      | 0.12 | .007     | -0.04             | 0.12 | .762     | 1.35               | 2.94 | .139     | 0.43            | 2.81 | .879     |

Note. ES = Emotional Stability, E = Extraversion, O = Openness, A = Agreeableness, C = Conscientiousness; \*\*  $p < .01$  \*\*\*  $p < .001$

**Table OS 10**

Unstandardized interaction coefficient between student rated personality and immigration status with social relationships

|                                | Helpfulness |      |          | Aggressiveness |      |          | Student-teacher RS |      |          |
|--------------------------------|-------------|------|----------|----------------|------|----------|--------------------|------|----------|
|                                | <i>b</i>    | SE   | <i>p</i> | <i>b</i>       | SE   | <i>p</i> | <i>b</i>           | SE   | <i>p</i> |
| <i>ES × immigration status</i> |             |      |          |                |      |          |                    |      |          |
| 5th grade                      | 0.03        | 0.13 | .786     | 0.16           | 0.16 | .314     | 0.04               | 0.18 | .824     |
| 7th grade                      | 0.01        | 0.08 | .903     | 0.12           | 0.10 | .221     | -0.11              | 0.11 | .300     |
| 9th grade                      | -0.06       | 0.12 | .627     | -0.09          | 0.09 | .312     | 0.08               | 0.12 | .537     |
| <i>E × immigration status</i>  |             |      |          |                |      |          |                    |      |          |
| 5th grade                      | -0.11       | 0.10 | .270     | 0.13           | 0.12 | .255     | 0.04               | 0.14 | .798     |
| 7th grade                      | -0.07       | 0.06 | .269     | 0.01           | 0.08 | .906     | -0.01              | 0.10 | .962     |
| 9th grade                      | -0.01       | 0.07 | .846     | -0.06          | 0.05 | .212     | 0.05               | 0.08 | .525     |
| <i>O × immigration status</i>  |             |      |          |                |      |          |                    |      |          |
| 5th grade                      | -0.03       | 0.13 | .842     | 0.00           | 0.16 | .992     | 0.09               | 0.18 | .625     |
| 7th grade                      | 0.01        | 0.09 | .895     | 0.03           | 0.11 | .785     | -0.09              | 0.11 | .394     |
| 9th grade                      | -0.10       | 0.14 | .472     | <b>-0.26**</b> | 0.10 | .007     | -0.01              | 0.14 | .939     |
| <i>A × immigration status</i>  |             |      |          |                |      |          |                    |      |          |
| 5th grade                      | -0.16       | 0.11 | .156     | 0.01           | 0.13 | .950     | 0.08               | 0.16 | .618     |
| 7th grade                      | -0.11       | 0.08 | .192     | -0.02          | 0.10 | .831     | 0.06               | 0.09 | .497     |
| 9th grade                      | -0.07       | 0.11 | .565     | -0.18          | 0.10 | .087     | -0.14              | 0.11 | .218     |
| <i>C × immigration status</i>  |             |      |          |                |      |          |                    |      |          |
| 5th grade                      | 0.04        | 0.11 | .680     | 0.02           | 0.12 | .867     | 0.22               | 0.14 | .121     |
| 7th grade                      | -0.05       | 0.07 | .469     | 0.09           | 0.07 | .190     | 0.00               | 0.09 | .960     |
| 9th grade                      | -0.10       | 0.08 | .218     | -0.07          | 0.07 | .376     | 0.07               | 0.12 | .562     |

Note. ES = Emotional Stability, E = Extraversion, O = Openness, A = Agreeableness, C = Conscientiousness, RS = Relationship; \*\*  $p < .01$  \*\*\*  $p < .001$

**Table OS 11**

Unstandardized interaction coefficient between student rated personality and immigration status with psychosocial adjustment

|                                | Self-esteem |      |          | Well-being at school |      |          | Health problems |      |          |
|--------------------------------|-------------|------|----------|----------------------|------|----------|-----------------|------|----------|
|                                | <i>b</i>    | SE   | <i>p</i> | <i>b</i>             | SE   | <i>p</i> | <i>b</i>        | SE   | <i>p</i> |
| <i>ES × immigration status</i> |             |      |          |                      |      |          |                 |      |          |
| 5th grade                      | -0.21       | 0.12 | .078     | 0.04                 | 0.13 | .760     | 0.01            | 0.06 | .836     |
| 7th grade                      | -0.12       | 0.07 | .096     | -0.15                | 0.08 | .056     | 0.00            | 0.05 | 1.00     |
| 9th grade                      | 0.01        | 0.08 | .922     | -0.11                | 0.09 | .181     | -0.00           | 0.06 | .963     |
| <i>E × immigration status</i>  |             |      |          |                      |      |          |                 |      |          |
| 5th grade                      | -0.10       | 0.12 | .389     | -0.05                | 0.10 | .643     | -0.00           | 0.05 | .939     |
| 7th grade                      | -0.05       | 0.07 | .464     | -0.09                | 0.07 | .181     | -0.00           | 0.04 | .933     |
| 9th grade                      | -0.05       | 0.06 | .432     | -0.10                | 0.06 | .118     | 0.02            | 0.04 | .664     |
| <i>O × immigration status</i>  |             |      |          |                      |      |          |                 |      |          |
| 5th grade                      | -0.10       | 0.11 | .365     | 0.12                 | 0.13 | .339     | 0.02            | 0.06 | .727     |
| 7th grade                      | -0.03       | 0.08 | .689     | 0.02                 | 0.08 | .816     | -0.01           | 0.04 | .819     |
| 9th grade                      | -0.03       | 0.08 | .686     | -0.02                | 0.09 | .800     | 0.02            | 0.06 | .768     |
| <i>A × immigration status</i>  |             |      |          |                      |      |          |                 |      |          |
| 5th grade                      | -0.22       | 0.11 | .038     | -0.10                | 0.12 | .404     | 0.02            | 0.05 | .702     |
| 7th grade                      | -0.15       | 0.09 | .099     | -0.08                | 0.08 | .326     | -0.03           | 0.04 | .522     |
| 9th grade                      | 0.11        | 0.08 | .165     | -0.08                | 0.09 | .342     | 0.01            | 0.06 | .849     |
| <i>C × immigration status</i>  |             |      |          |                      |      |          |                 |      |          |
| 5th grade                      | -0.16       | 0.10 | .114     | 0.11                 | 0.10 | .291     | 0.01            | 0.05 | .769     |
| 7th grade                      | -0.08       | 0.08 | .329     | -0.06                | 0.06 | .358     | 0.02            | 0.04 | .665     |
| 9th grade                      | -0.00       | 0.07 | .980     | 0.00                 | 0.08 | 1        | 0.00            | 0.04 | .965     |

Note. ES = Emotional Stability, E = Extraversion, O = Openness, A = Agreeableness, C = Conscientiousness; \*\*  $p < .01$  \*\*\*  $p < .001$

**Table OS 12**

*Unstandardized Regression Effects of Self- and Parent-Reported Personality on the Four Achievement Outcome Variables in Grades 5, 7, and 9 Including Unadjusted and Adjusted p-Values*

|     |         | German school grade |          |       |       |         |             |       |             | Mathematics school grade |             |       |             |         |             |             |       |
|-----|---------|---------------------|----------|-------|-------|---------|-------------|-------|-------------|--------------------------|-------------|-------|-------------|---------|-------------|-------------|-------|
|     |         | Adolescents         |          |       |       | Parents |             |       |             | Adolescents              |             |       |             | Parents |             |             |       |
|     |         | $\beta$             | <i>p</i> | BY    | BH    | $\beta$ | <i>p</i>    | BY    | BH          | $\beta$                  | <i>p</i>    | BY    | BH          | $\beta$ | <i>p</i>    | BY          | BH    |
| ES  | Grade 5 | /                   | /        | /     | /     | /       | /           | /     | /           | /                        | /           | /     | /           | /       | /           | /           | /     |
|     | Grade 7 | 0.45***             | <.001    | <.001 | <.001 | 0.28**  | .004        | .050  | .008        | 0.34***                  | <.001       | <.001 | <.001       | 0.29**  | .003        | .040        | .006  |
|     | Grade 9 | 0.16                | .074     | .610  | .098  | 0.12    | .085        | .688  | .111        | 0.03                     | .804        | 1     | .837        | 0.09    | .235        | 1           | .276  |
| E   | Grade 5 | /                   | /        | /     | /     | /       | /           | /     | /           | /                        | /           | /     | /           | /       | /           | /           | /     |
|     | Grade 7 | 0.38***             | <.001    | <.001 | <.001 | 0.06    | .461        | 1     | .512        | 0.30***                  | <.001       | <.001 | <.001       | 0.04    | .646        | 1           | .690  |
|     | Grade 9 | 0.01                | .861     | 1     | .880  | -0.04   | .346        | 1     | .395        | -0.13                    | <b>.026</b> | .247  | <b>.040</b> | -0.12   | .057        | .491        | .079  |
| O   | Grade 5 | /                   | /        | /     | /     | /       | /           | /     | /           | /                        | /           | /     | /           | /       | /           | /           | /     |
|     | Grade 7 | 0.30***             | <.001    | <.001 | <.001 | 0.22*** | <.001       | <.001 | <.001       | 0.53***                  | <.001       | <.001 | <.001       | 0.38**  | .001        | .015        | .002  |
|     | Grade 9 | 0.19**              | .001     | .015  | .002  | 0.13    | <b>.010</b> | .108  | <b>.017</b> | 0.23                     | <b>.031</b> | .285  | <b>.046</b> | 0.10    | .407        | 1           | .460  |
| A   | Grade 5 | /                   | /        | /     | /     | /       | /           | /     | /           | /                        | /           | /     | /           | /       | /           | /           | /     |
|     | Grade 7 | 0.36***             | <.001    | <.001 | <.001 | 0.21    | <b>.027</b> | .254  | <b>.041</b> | 0.30***                  | <.001       | <.001 | <.001       | 0.12    | .237        | 1           | .278  |
|     | Grade 9 | 0.09                | .312     | 1     | .358  | -0.02   | .763        | 1     | .797        | 0.04                     | .648        | 1     | .670        | 0.02    | .841        | 1           | .866  |
| C   | Grade 5 | /                   | /        | /     | /     | /       | /           | /     | /           | /                        | /           | /     | /           | /       | /           | /           | /     |
|     | Grade 7 | 0.40***             | <.001    | <.001 | <.001 | 0.36*** | <.001       | <.001 | <.001       | 0.34***                  | <.001       | <.001 | <.001       | 0.31*** | <.001       | <.001       | <.001 |
|     | Grade 9 | 0.23**              | .004     | .050  | .008  | 0.22*** | <.001       | <.001 | <.001       | 0.27***                  | <.001       | <.001 | <.001       | 0.24*** | <.001       | <.001       | <.001 |
| Fit | CFI     | .95-.97             |          |       |       | .95-.98 |             |       |             | .95-.98                  |             |       |             | .95-.98 |             |             |       |
|     | RMSEA   | .04-.05             |          |       |       | .03-.07 |             |       |             | .04-.05                  |             |       |             | .03-.07 |             |             |       |
|     | SRMR    | .02-.03             |          |       |       | .02-.03 |             |       |             | .02-.03                  |             |       |             | .02-.03 |             |             |       |
|     |         | Reading competence  |          |       |       |         |             |       |             | Mathematics competence   |             |       |             |         |             |             |       |
|     |         | Adolescents         |          |       |       | Parents |             |       |             | Adolescents              |             |       |             | Parents |             |             |       |
|     |         | $\beta$             | <i>p</i> | BY    | BH    | $\beta$ | <i>p</i>    | BY    | BH          | $\beta$                  | <i>p</i>    | BY    | BH          | $\beta$ | <i>p</i>    | BY          | BH    |
| ES  | Grade 5 | 19.67***            | <.001    | <.001 | <.001 | 6.77**  | .003        | .040  | .006        | 17.19***                 | <.001       | <.001 | <.001       | 5.99**  | <b>.007</b> | <b>.080</b> | .013  |
|     | Grade 7 | 11.58***            | <.001    | <.001 | <.001 | 4.16    | .055        | .478  | .077        | 10.03***                 | <.001       | <.001 | <.001       | 5.97**  | <b>.009</b> | <b>.099</b> | .016  |

|     |         |          |             |             |             |          |             |             |             |          |             |             |             |          |             |       |             |
|-----|---------|----------|-------------|-------------|-------------|----------|-------------|-------------|-------------|----------|-------------|-------------|-------------|----------|-------------|-------|-------------|
|     | Grade 9 | 6.28**   | .004        | .050        | .008        | 4.60**   | <b>.007</b> | <b>.080</b> | .012        | 6.38**   | .002        | .027        | .004        | 3.06     | .046        | .408  | .066        |
| E   | Grade 5 | 12.62*** | <.001       | <.001       | <.001       | 3.22     | .049        | .433        | .070        | 8.70**   | <b>.009</b> | <b>.099</b> | .016        | 2.49     | .113        | .890  | .143        |
|     | Grade 7 | 8.59***  | <.001       | <.001       | <.001       | 3.21     | .071        | .588        | .095        | 6.81***  | <.001       | <.001       | <.001       | 3.93     | <b>.026</b> | .247  | <b>.040</b> |
|     | Grade 9 | 0.78     | .644        | 1           | .690        | 0.92     | .513        | 1           | .563        | 0.29     | .824        | 1           | .851        | 0.31     | .807        | 1     | .837        |
| O   | Grade 5 | 21.81*** | <.001       | <.001       | <.001       | 17.08*** | <.001       | <.001       | <.001       | 18.52*** | <.001       | <.001       | <.001       | 11.99*** | <.001       | <.001 | <.001       |
|     | Grade 7 | 14.77*** | <.001       | <.001       | <.001       | 11.78*** | <.001       | <.001       | <.001       | 13.09*** | <.001       | <.001       | <.001       | 8.25***  | <.001       | <.001 | <.001       |
|     | Grade 9 | 8.36***  | <.001       | <.001       | <.001       | 9.09***  | <.001       | <.001       | <.001       | 4.65     | .036        | .328        | .053        | 6.53**   | .001        | .015  | .002        |
| A   | Grade 5 | 11.93**  | .001        | .015        | .002        | 6.77     | <b>.012</b> | .124        | <b>.020</b> | 6.88     | .081        | .659        | .106        | 2.59     | .253        | 1     | .295        |
|     | Grade 7 | 6.51**   | <b>.005</b> | <b>.061</b> | .010        | 1.64     | .466        | 1           | .516        | 4.29     | <b>.028</b> | .262        | <b>.042</b> | 0.22     | .916        | 1     | .933        |
|     | Grade 9 | 2.27     | .276        | 1           | .319        | -1.07    | .569        | 1           | .618        | 2.91     | .120        | .936        | .151        | 0.13     | .942        | 1     | .950        |
| C   | Grade 5 | 7.89     | <b>.011</b> | .116        | <b>.019</b> | 2.32     | .196        | 1           | .236        | 7.49     | <b>.011</b> | .116        | <b>.019</b> | 1.61     | .429        | 1     | .482        |
|     | Grade 7 | 4.39**   | .001        | .015        | .002        | 2.20     | .199        | 1           | .238        | 5.04**   | .001        | .015        | .002        | 2.87     | .069        | .574  | .092        |
|     | Grade 9 | 2.34     | .101        | .806        | .130        | 0.41     | .754        | 1           | .791        | 3.31     | <b>.017</b> | .168        | <b>.027</b> | 3.11     | <b>.010</b> | .108  | <b>.017</b> |
| Fit | CFI     |          | .96-.98     |             |             |          | .95-.99     |             |             |          | .97-.98     |             |             |          | .96-.99     |       |             |
|     | RMSEA   |          | .04-.06     |             |             |          | .03-.07     |             |             |          | .04-.05     |             |             |          | .03-.08     |       |             |
|     | SRMR    |          | .03         |             |             |          | .02-.03     |             |             |          | .03         |             |             |          | .02-.03     |       |             |

Note. / = Not included in the analysis because of high proportions of missing data. All effects were controlled for gender, IQ, socioeconomic status, and immigration status.  $p$  = unadjusted  $p$ -value, BH = adjusted  $p$ -value after Benjamini & Hochberg (FDR), BY = adjusted  $p$ -value after Benjamini & Yekutieli. Bold values indicate different decisions based on the unadjusted compared to the adjusted  $p$ -values.  $N = 2,667$ .

\*\*  $p < .01$ . \*\*\*  $p < .001$ .

Table OS 13

Unstandardized Regression Effects of Self- and Parent-Reported Personality on the Social Relationship Variables in Grades 5, 7, and 9 Including Unadjusted and Adjusted *p*-Values

|     |         | Helpfulness |             |             |             |         |             |             |             | Aggressiveness |             |             |             |         |             |             |             | Teacher-student relationship |             |             |       |         |             |             |             |  |
|-----|---------|-------------|-------------|-------------|-------------|---------|-------------|-------------|-------------|----------------|-------------|-------------|-------------|---------|-------------|-------------|-------------|------------------------------|-------------|-------------|-------|---------|-------------|-------------|-------------|--|
|     |         | Adolescents |             |             |             | Parents |             |             |             | Adolescents    |             |             |             | Parents |             |             |             | Adolescents                  |             |             |       | Parents |             |             |             |  |
|     |         | $\beta$     | <i>p</i>    | BY          | BH          | $\beta$ | <i>p</i>    | BY          | BH          | $\beta$        | <i>p</i>    | BY          | BH          | $\beta$ | <i>p</i>    | BY          | BH          | $\beta$                      | <i>p</i>    | BY          | BH    | $\beta$ | <i>p</i>    | BY          | BH          |  |
| ES  | Grade 5 | 0.26***     | <.001       | <.001       | <.001       | 0.13*** | <.001       | .027        | .004        | -0.16          | <b>.027</b> | .254        | <b>.041</b> | -0.02   | .715        | 1           | .753        | 0.31**                       | .001        | .015        | .002  | 0.11    | .060        | .509        | .082        |  |
|     | Grade 7 | 0.10**      | .004        | .050        | .008        | 0.14*** | <.001       | .015        | .002        | -0.05          | .226        | 1           | .267        | -0.07   | .165        | 1           | .200        | 0.22***                      | <.001       | <.001       | <.001 | 0.12    | <b>.011</b> | .116        | <b>.019</b> |  |
|     | Grade 9 | 0.13        | .107        | .850        | .137        | 0.20*** | <.001       | .015        | .002        | -0.05          | .127        | .986        | .159        | -0.05   | .146        | 1           | .179        | 0.03                         | .623        | 1           | .671  | 0.04    | .551        | 1           | .600        |  |
| E   | Grade 5 | 0.16**      | <b>.007</b> | <b>.080</b> | .013        | 0.03    | .453        | 1           | .507        | -0.02          | .688        | 1           | .730        | 0.02    | .588        | 1           | .636        | 0.30***                      | <.001       | <.001       | <.001 | 0.04    | .290        | 1           | .334        |  |
|     | Grade 7 | 0.13***     | <.001       | <.001       | <.001       | 0.11**  | .002        | .027        | .004        | -0.05          | .214        | 1           | .254        | 0.05    | .203        | 1           | .249        | 0.19***                      | <.001       | <.001       | <.001 | 0.13**  | <b>.006</b> | <b>.072</b> | .012        |  |
|     | Grade 9 | 0.07        | .094        | .754        | .121        | 0.10**  | .001        | .015        | .002        | 0.04           | .131        | 1           | .163        | 0.07    | <b>.015</b> | .154        | <b>.025</b> | 0.01                         | .696        | 1           | .735  | 0.01    | .845        | 1           | .867        |  |
| O   | Grade 5 | 0.21        | <b>.010</b> | .108        | <b>.017</b> | 0.11**  | <b>.008</b> | <b>.090</b> | .015        | -0.11          | .155        | 1           | .190        | -0.08   | .045        | .402        | .065        | 0.41***                      | <.001       | <.001       | <.001 | 0.15    | <b>.017</b> | .168        | <b>.027</b> |  |
|     | Grade 7 | 0.13**      | .002        | .027        | .004        | 0.09    | .056        | .485        | .078        | -0.10          | .042        | .377        | .061        | 0.00    | .981        | 1           | .985        | 0.18**                       | .001        | .015        | .002  | 0.16    | <b>.019</b> | .186        | <b>.030</b> |  |
|     | Grade 9 | 0.18**      | <b>.007</b> | <b>.080</b> | .013        | 0.15    | <b>.017</b> | .168        | <b>.027</b> | -0.10**        | <b>.006</b> | <b>.072</b> | .012        | -0.00   | .934        | 1           | .948        | 0.11                         | .135        | 1           | .167  | 0.06    | .387        | 1           | .440        |  |
| A   | Grade 5 | 0.26***     | <.001       | <.001       | <.001       | 0.14**  | .003        | .040        | .006        | -0.21**        | .001        | .015        | .002        | -.23*** | <.001       | <.001       | <.001       | 0.33**                       | .001        | .015        | .002  | 0.09    | .185        | 1           | .223        |  |
|     | Grade 7 | 0.16***     | <.001       | <.001       | <.001       | 0.09    | .054        | .475        | .076        | -.18***        | <.001       | <.001       | <.001       | -.18*** | <.001       | <.001       | <.001       | 0.29***                      | <.001       | <.001       | <.001 | 0.23**  | .001        | .015        | .002        |  |
|     | Grade 9 | 0.15        | .036        | .328        | .053        | 0.18**  | .003        | .040        | .006        | -.20***        | <.001       | <.001       | <.001       | -0.12** | .001        | .015        | .002        | 0.25***                      | <.001       | <.001       | <.001 | 0.15    | <b>.015</b> | .154        | <b>.025</b> |  |
| C   | Grade 5 | 0.14        | <b>.021</b> | .202        | <b>.032</b> | 0.15*** | <.001       | <.001       | <.001       | -0.15          | <b>.011</b> | .116        | <b>.019</b> | -.14*** | <.001       | <.001       | <.001       | 0.25**                       | .003        | .040        | .006  | 0.11    | <b>.021</b> | .202        | <b>.032</b> |  |
|     | Grade 7 | 0.11**      | .002        | .027        | .004        | 0.07    | .040        | .362        | .058        | -0.11**        | .004        | .050        | .008        | -.14*** | <.001       | <.001       | <.001       | 0.14**                       | .002        | .027        | .004  | 0.17*** | <.001       | <.001       | <.001       |  |
|     | Grade 9 | 0.18***     | <.001       | <.001       | <.001       | 0.14**  | <b>.005</b> | <b>.061</b> | .010        | -0.08**        | <b>.007</b> | <b>.080</b> | .013        | -0.07** | <b>.006</b> | <b>.072</b> | .016        | 0.13**                       | <b>.007</b> | <b>.080</b> | .013  | 0.14**  | .002        | .027        | .004        |  |
| Fit | CFI     |             | .93-.96     |             |             |         | .94-.98     |             |             |                | .95-.98     |             |             |         | .95-.98     |             |             |                              | .93-.97     |             |       |         | .95-.98     |             |             |  |
|     | RMSEA   |             | .04-.05     |             |             |         | .03-.07     |             |             |                | .04-.05     |             |             |         | .04-.07     |             |             |                              | .04-.05     |             |       |         | .03-.07     |             |             |  |
|     | SRMR    |             | .02-.03     |             |             |         | .02-.03     |             |             |                | .02-.03     |             |             |         | .02-.03     |             |             |                              | .02-.03     |             |       |         | .02-.03     |             |             |  |

Note. All effects were controlled for gender, IQ, socioeconomic status, and immigration status. *p* = unadjusted *p*-value, BH = adjusted *p*-value after Benjamini & Hochberg (FDR), BY = adjusted *p*-value after Benjamini & Yekutieli. Bold values indicate different decisions based on the unadjusted compared to the adjusted *p*-values. N = 2,667.

\*\* *p* < .01. \*\*\* *p* < .001.

Table OS 14

Unstandardized Regression Effects of Self- and Parent-Reported Personality on the Psychosocial Adjustment Variables in Grades 5, 7, and 9 Including Unadjusted and Adjusted *p*-Values

|     |         | Self-esteem |          |       |       |         |             |             |             | Well-being in school |          |       |       |         |             |             |             | Health problems |             |       |             |          |             |             |             |
|-----|---------|-------------|----------|-------|-------|---------|-------------|-------------|-------------|----------------------|----------|-------|-------|---------|-------------|-------------|-------------|-----------------|-------------|-------|-------------|----------|-------------|-------------|-------------|
|     |         | Adolescents |          |       |       | Parents |             |             |             | Adolescents          |          |       |       | Parents |             |             |             | Adolescents     |             |       |             | Parents  |             |             |             |
|     |         | $\beta$     | <i>p</i> | BY    | BH    | $\beta$ | <i>p</i>    | BY          | BH          | $\beta$              | <i>p</i> | BY    | BH    | $\beta$ | <i>p</i>    | BY          | BH          | $\beta$         | <i>p</i>    | BY    | BH          | $\beta$  | <i>p</i>    | BY          | BH          |
| ES  | Grade 5 | 0.61***     | <.001    | <.001 | <.001 | 0.10    | .115        | .901        | .145        | 0.43***              | <.001    | <.001 | <.001 | 0.15**  | .001        | .015        | .002        | -0.02           | .503        | 1     | .554        | -0.07*** | <.001       | <.001       | <.001       |
|     | Grade 7 | 0.51***     | <.001    | <.001 | <.001 | 0.21*** | <.001       | <.001       | <.001       | 0.31***              | <.001    | <.001 | <.001 | 0.23*** | <.001       | <.001       | <.001       | -0.08***        | <.001       | <.001 | <.001       | -0.14*** | <.001       | <.001       | <.001       |
|     | Grade 9 | 0.46***     | <.001    | <.001 | <.001 | 0.19*** | <.001       | <.001       | <.001       | 0.29***              | <.001    | <.001 | <.001 | 0.14**  | <b>.007</b> | <b>.080</b> | .013        | -0.06           | .055        | .478  | .077        | -0.08*** | <.001       | <.001       | <.001       |
| E   | Grade 5 | 0.43***     | <.001    | <.001 | <.001 | 0.06    | .181        | 1           | .219        | 0.31***              | <.001    | <.001 | <.001 | 0.10    | <b>.017</b> | .168        | <b>.027</b> | -0.02           | .457        | 1     | .510        | -0.03    | <b>.031</b> | .285        | <b>.046</b> |
|     | Grade 7 | 0.36***     | <.001    | <.001 | <.001 | 0.13**  | .002        | .027        | .004        | 0.34***              | <.001    | <.001 | <.001 | 0.15*** | <.001       | <.001       | <.001       | -0.04           | .058        | .494  | .080        | -0.09*** | <.001       | <.001       | <.001       |
|     | Grade 9 | 0.23***     | <.001    | <.001 | <.001 | 0.09    | <b>.012</b> | .124        | <b>.020</b> | 0.25***              | <.001    | <.001 | <.001 | 0.14*** | <.001       | <.001       | <.001       | -0.02           | .260        | 1     | .302        | -0.04    | <b>.012</b> | .124        | <b>.020</b> |
| O   | Grade 5 | 0.53***     | <.001    | <.001 | <.001 | 0.12    | .058        | .495        | .080        | 0.37***              | <.001    | <.001 | <.001 | 0.13    | <b>.017</b> | .168        | <b>.027</b> | 0.00            | .999        | 1     | .999        | -0.07*** | <.001       | <.001       | <.001       |
|     | Grade 7 | 0.43***     | <.001    | <.001 | <.001 | 0.20*** | <.001       | <.001       | <.001       | 0.23***              | <.001    | <.001 | <.001 | 0.12    | .041        | .370        | .059        | -0.04           | .068        | .569  | .091        | -0.09*** | <.001       | <.001       | <.001       |
|     | Grade 9 | 0.41***     | <.001    | <.001 | <.001 | 0.20*** | <.001       | <.001       | <.001       | 0.17**               | .002     | .027  | .004  | 0.05    | .404        | 1           | .458        | 0.02            | .540        | 1     | .591        | -0.06    | <b>.020</b> | .194        | <b>.031</b> |
| A   | Grade 5 | 0.52***     | <.001    | <.001 | <.001 | 0.13    | .066        | .555        | .089        | 0.32***              | <.001    | <.001 | <.001 | 0.09    | .081        | .659        | .106        | -0.00           | .943        | 1     | .950        | -0.05**  | <b>.009</b> | <b>.099</b> | .016        |
|     | Grade 7 | 0.32***     | <.001    | <.001 | <.001 | 0.10    | .075        | .616        | .099        | 0.19***              | <.001    | <.001 | <.001 | 0.17**  | .004        | .050        | .008        | -0.04           | <b>.031</b> | .285  | <b>.046</b> | -0.07**  | .002        | .027        | .004        |
|     | Grade 9 | 0.25***     | <.001    | <.001 | <.001 | 0.14**  | <b>.009</b> | <b>.099</b> | .016        | 0.15**               | .002     | .027  | .004  | 0.12    | <b>.018</b> | .177        | <b>.028</b> | -0.05           | .108        | .854  | .137        | -0.09*** | <.001       | <.001       | <.001       |
| C   | Grade 5 | 0.41***     | <.001    | <.001 | <.001 | 0.14**  | .004        | .050        | .008        | 0.21**               | .004     | .050  | .008  | 0.15*** | <.001       | <.001       | <.001       | -0.04           | .090        | .725  | .117        | -0.06*** | <.001       | <.001       | <.001       |
|     | Grade 7 | 0.33***     | <.001    | <.001 | <.001 | 0.15*** | <.001       | <.001       | <.001       | 0.23***              | <.001    | <.001 | <.001 | 0.16*** | <.001       | <.001       | <.001       | -0.04           | <b>.017</b> | .168  | <b>.027</b> | -0.05*** | <.001       | <.001       | <.001       |
|     | Grade 9 | 0.26***     | <.001    | <.001 | <.001 | 0.10**  | <b>.008</b> | <b>.090</b> | .015        | 0.14***              | <.001    | <.001 | <.001 | 0.07    | .062        | .524        | .084        | -0.03           | .137        | 1     | .169        | -0.06*** | <.001       | <.001       | <.001       |
| Fit | CFI     | .95-.97     |          |       |       | .95-.98 |             |             |             | .94-.97              |          |       |       | .94-.98 |             |             |             | .94-.96         |             |       |             | .95-.97  |             |             |             |
|     | RMSEA   | .04-.05     |          |       |       | .03-.07 |             |             |             | .04-.06              |          |       |       | .04-.07 |             |             |             | .04-.05         |             |       |             | .04-.07  |             |             |             |
|     | SRMR    | .02-.03     |          |       |       | .02-.03 |             |             |             | .03                  |          |       |       | .02-.03 |             |             |             | .02-.03         |             |       |             | .02-.03  |             |             |             |

Note. All effects were controlled for gender, IQ, socioeconomic status, and immigration status. *p* = unadjusted *p*-value, BH = adjusted *p*-value after Benjamini & Hochberg (FDR), BY = adjusted *p*-value after Benjamini & Yekutieli. Bold values indicate different decisions based on the unadjusted compared to the adjusted *p*-values. N = 2,667.

\*\* *p* < .01. \*\*\* *p* < .001.



Table OS 15

Unstandardized Regression Effects of Grade Differences between Self- and Parent-Reported Personality-Achievement-Associations Including Unadjusted and Adjusted *p*-Values

|    |           | German school grade |             |             |             |         |          |    |      | Mathematics school grade |             |             |             |         |          |    |      |
|----|-----------|---------------------|-------------|-------------|-------------|---------|----------|----|------|--------------------------|-------------|-------------|-------------|---------|----------|----|------|
|    |           | Adolescents         |             |             |             | Parents |          |    |      | Adolescents              |             |             |             | Parents |          |    |      |
|    |           | $\beta$             | <i>p</i>    | BY          | BH          | $\beta$ | <i>p</i> | BY | BH   | $\beta$                  | <i>p</i>    | BY          | BH          | $\beta$ | <i>p</i> | BY | BH   |
| ES | Diff. 9_7 | -0.29               | .012        | 1           | .164        | -0.17   | .170     | 1  | .581 | -0.32                    | .023        | 1           | .239        | -0.21   | .095     | 1  | .466 |
| E  | Diff. 9_7 | -0.37***            | <.001       | <.001       | <.001       | -0.10   | .271     | 1  | .649 | -0.44***                 | <.001       | <.001       | <.001       | -0.16   | .119     | 1  | .491 |
| O  | Diff. 9_7 | -0.26               | .068        | 1           | .413        | -0.22   | .107     | 1  | .489 | -0.30                    | .034        | 1           | .314        | -0.28   | .078     | 1  | .413 |
| A  | Diff. 9_7 | -0.26               | .043        | 1           | .339        | 0.24    | .059     | 1  | .340 | -0.26                    | .040        | 1           | .335        | -0.11   | .411     | 1  | .694 |
| C  | Diff. 9_7 | -0.17               | .129        | 1           | .516        | -0.14   | .116     | 1  | .491 | -0.07                    | .488        | 1           | .738        | -0.07   | .502     | 1  | .738 |
|    |           | Reading competence  |             |             |             |         |          |    |      | Mathematics competence   |             |             |             |         |          |    |      |
|    |           | Adolescents         |             |             |             | Parents |          |    |      | Adolescents              |             |             |             | Parents |          |    |      |
|    |           | $\beta$             | <i>p</i>    | BY          | BH          | $\beta$ | <i>p</i> | BY | BH   | $\beta$                  | <i>p</i>    | BY          | BH          | $\beta$ | <i>p</i> | BY | BH   |
| ES | Diff. 7_5 | -8.08               | .080        | 1           | .413        | -2.61   | .411     | 1  | .956 | -7.16                    | .114        | 1           | .491        | -0.02   | .995     | 1  | .996 |
|    | Diff. 9_5 | -13.38**            | <b>.005</b> | <b>.614</b> | <b>.100</b> | -2.17   | .451     | 1  | .723 | -10.81                   | .020        | 1           | .236        | -2.93   | .281     | 1  | .649 |
|    | Diff. 9_7 | -5.30               | .059        | 1           | .400        | 0.44    | .879     | 1  | .694 | -3.65                    | .185        | 1           | .590        | -2.91   | .296     | 1  | .649 |
| E  | Diff. 7_5 | -4.03               | .297        | 1           | .649        | -0.01   | .996     | 1  | .996 | -1.89                    | .608        | 1           | .797        | 1.44    | .539     | 1  | .766 |
|    | Diff. 9_5 | -11.83**            | <b>.002</b> | <b>.456</b> | <b>.074</b> | -2.30   | .282     | 1  | .649 | -8.41                    | .020        | 1           | .236        | -2.18   | .281     | 1  | .649 |
|    | Diff. 9_7 | -7.81**             | <b>.001</b> | <b>.399</b> | <b>.065</b> | -2.28   | .325     | 1  | .653 | -6.52**                  | <b>.002</b> | <b>.456</b> | <b>.074</b> | -3.62   | .109     | 1  | .489 |
| O  | Diff. 7_5 | -7.04               | .178        | 1           | .590        | -5.29   | .168     | 1  | .581 | -5.43                    | .283        | 1           | .649        | -3.74   | .310     | 1  | .650 |
|    | Diff. 9_5 | -13.44              | .012        | 1           | .164        | -7.98   | .035     | 1  | .314 | -13.87**                 | <b>.006</b> | <b>.639</b> | <b>.104</b> | -5.47   | .113     | 1  | .491 |
|    | Diff. 9_7 | -6.41               | .031        | 1           | .310        | -2.69   | .429     | 1  | .706 | -8.44**                  | <b>.005</b> | <b>.614</b> | <b>.100</b> | -1.72   | .578     | 1  | .776 |
| A  | Diff. 7_5 | -5.42               | .212        | 1           | .602        | -5.13   | .151     | 1  | .561 | -2.59                    | .553        | 1           | .766        | -2.36   | .454     | 1  | .723 |
|    | Diff. 9_5 | -9.66               | .022        | 1           | .238        | -7.85   | .020     | 1  | .236 | -3.98                    | .366        | 1           | .690        | -2.46   | .382     | 1  | .690 |
|    | Diff. 9_7 | -4.24               | .172        | 1           | .581        | -2.71   | .338     | 1  | .666 | -1.38                    | .607        | 1           | .797        | -0.10   | .972     | 1  | .987 |
| C  | Diff. 7_5 | -3.50               | .296        | 1           | .649        | -0.12   | .963     | 1  | .987 | -2.45                    | .459        | 1           | .723        | 1.26    | .630     | 1  | .811 |
|    | Diff. 9_5 | -5.55               | .108        | 1           | .489        | -1.91   | .382     | 1  | .690 | -4.18                    | .199        | 1           | .590        | 1.50    | .530     | 1  | .761 |
|    | Diff. 9_7 | -2.05               | .296        | 1           | .649        | -1.79   | .391     | 1  | .694 | -1.73                    | .420        | 1           | .705        | 0.24    | .905     | 1  | .972 |

Note. Diff 5\_7, 5\_9, and 7\_9 describe the effects for differences between the respective grades 5, 7, and 9. Diff. 5\_7 and diff. 5\_9 with school grades are not included in the analysis because of excluding personality-grade-associations due to high proportions of missing data. All effects were controlled for gender, IQ, socioeconomic status, and immigration status. *p* = unadjusted *p*-value, BH = adjusted *p*-value after Benjamini & Hochberg (FDR), BY = adjusted *p*-value after Benjamini & Yekutieli. Bold values indicate different decisions based on the unadjusted compared to the adjusted *p*-values. N = 2,667.

\*\* *p* < .01. \*\*\* *p* < .001.

Table OS 16

Unstandardized Regression Effects of Grade Differences between Self- and Parent-Reported Personality-Social-Relationship-Associations Including Unadjusted and Adjusted *p*-Values

|    |           | Helpfulness |          |    |      |         |          |    |      | Aggressiveness |          |    |      |         |          |    |      | Teacher-student relationship |             |             |             |         |          |    |      |
|----|-----------|-------------|----------|----|------|---------|----------|----|------|----------------|----------|----|------|---------|----------|----|------|------------------------------|-------------|-------------|-------------|---------|----------|----|------|
|    |           | Adolescents |          |    |      | Parents |          |    |      | Adolescents    |          |    |      | Parents |          |    |      | Adolescents                  |             |             |             | Parents |          |    |      |
|    |           | $\beta$     | <i>p</i> | BY | BH   | $\beta$ | <i>p</i> | BY | BH   | $\beta$        | <i>p</i> | BY | BH   | $\beta$ | <i>p</i> | BY | BH   | $\beta$                      | <i>p</i>    | BY          | BH          | $\beta$ | <i>p</i> | BY | BH   |
| ES | Diff. 7_5 | -0.16       | .043     | 1  | .339 | 0.01    | .806     | 1  | .911 | 0.10           | .224     | 1  | .607 | -0.05   | .424     | 1  | .705 | -0.09                        | .410        | 1           | .694        | 0.01    | .858     | 1  | .941 |
|    | Diff. 9_5 | -0.13       | .218     | 1  | .603 | 0.08    | .304     | 1  | .649 | 0.11           | .186     | 1  | .590 | -0.03   | .524     | 1  | .760 | -0.29                        | .012        | 1           | .164        | -0.07   | .409     | 1  | .694 |
|    | Diff. 9_7 | 0.03        | .730     | 1  | .880 | 0.06    | .409     | 1  | .694 | 0.00           | .972     | 1  | .987 | 0.02    | .781     | 1  | .891 | -0.20**                      | <b>.006</b> | <b>.639</b> | <b>.104</b> | -0.08   | .275     | 1  | .649 |
| E  | Diff. 7_5 | -0.03       | .629     | 1  | .812 | 0.08    | .079     | 1  | .413 | -0.02          | .733     | 1  | .880 | 0.03    | .560     | 1  | .766 | -0.12                        | .188        | 1           | .590        | 0.09    | .133     | 1  | .516 |
|    | Diff. 9_5 | -0.09       | .191     | 1  | .590 | 0.08    | .085     | 1  | .425 | 0.06           | .347     | 1  | .673 | 0.05    | .307     | 1  | .649 | 0.29**                       | <b>.001</b> | <b>.399</b> | <b>.065</b> | -0.03   | .595     | 1  | .793 |
|    | Diff. 9_7 | -0.06       | .202     | 1  | .590 | -0.01   | .894     | 1  | .969 | 0.08           | .063     | 1  | .340 | 0.02    | .767     | 1  | .891 | -0.17**                      | <b>.002</b> | <b>.456</b> | <b>.074</b> | -0.13   | .056     | 1  | .340 |
| O  | Diff. 7_5 | -0.08       | .400     | 1  | .694 | -0.02   | .745     | 1  | .880 | 0.01           | .950     | 1  | .984 | 0.08    | .233     | 1  | .618 | -0.23                        | .074        | 1           | .413        | 0.01    | .909     | 1  | .973 |
|    | Diff. 9_5 | -0.03       | .771     | 1  | .891 | 0.03    | .650     | 1  | .824 | 0.00           | .984     | 1  | .992 | 0.08    | .171     | 1  | .581 | -0.31                        | .022        | 1           | .238        | -0.90   | .324     | 1  | .653 |
|    | Diff. 9_7 | 0.05        | .560     | 1  | .766 | 0.05    | .490     | 1  | .738 | -0.00          | .950     | 1  | .984 | -0.01   | .947     | 1  | .984 | -0.08                        | .379        | 1           | .690        | -0.10   | .317     | 1  | .653 |
| A  | Diff. 7_5 | -0.10       | .190     | 1  | .590 | -0.05   | .452     | 1  | .723 | 0.03           | .697     | 1  | .857 | 0.05    | .526     | 1  | .760 | -0.04                        | .699        | 1           | .857        | 0.14    | .133     | 1  | .516 |
|    | Diff. 9_5 | -0.11       | .247     | 1  | .623 | 0.05    | .550     | 1  | .766 | 0.01           | .875     | 1  | .956 | 0.11    | .105     | 1  | .489 | -0.08                        | .494        | 1           | .738        | 0.06    | .462     | 1  | .724 |
|    | Diff. 9_7 | -0.01       | .917     | 1  | .977 | 0.10    | .216     | 1  | .603 | -0.02          | .754     | 1  | .885 | 0.06    | .329     | 1  | .653 | -0.04                        | .660        | 1           | .833        | -0.08   | .374     | 1  | .690 |
| C  | Diff. 7_5 | -0.03       | .682     | 1  | .857 | -0.08   | .060     | 1  | .400 | 0.04           | .549     | 1  | .766 | -0.00   | .931     | 1  | .981 | -0.10                        | .276        | 1           | .649        | 0.06    | .369     | 1  | .690 |
|    | Diff. 9_5 | 0.04        | .570     | 1  | .772 | -0.00   | .904     | 1  | .972 | 0.06           | .329     | 1  | .653 | 0.07    | .077     | 1  | .413 | -0.11                        | .238        | 1           | .619        | 0.03    | .706     | 1  | .861 |
|    | Diff. 9_7 | 0.07        | .236     | 1  | .619 | 0.08    | .194     | 1  | .590 | 0.02           | .618     | 1  | .803 | 0.07    | .075     | 1  | .413 | -0.01                        | .847        | 1           | .937        | -0.03   | .610     | 1  | .797 |

Note. Diff 5\_7, 5\_9, and 7\_9 describe the effects for differences between the respective grades 5, 7, and 9. All effects were controlled for gender, IQ, socioeconomic status, and immigration status. *p* = unadjusted *p*-value, BH = adjusted *p*-value after Benjamini & Hochberg (FDR), BY = adjusted *p*-value after Benjamini & Yekutieli. Bold values indicate different decisions based on the unadjusted compared to the adjusted *p*-values. N = 2,667.

\*\* *p* < .01. \*\*\* *p* < .001.

Table OS 17

Unstandardized Regression Effects of Grade Differences between Self- and Parent-Reported Personality-Psychosocial-Adjustment-Associations Including Unadjusted and Adjusted *p*-Values

|        |           | Self-esteem |             |             |             |         |          |    |      | Well-being in school |          |    |      |         |          |    |      | Health problems |          |    |      |         |             |             |             |
|--------|-----------|-------------|-------------|-------------|-------------|---------|----------|----|------|----------------------|----------|----|------|---------|----------|----|------|-----------------|----------|----|------|---------|-------------|-------------|-------------|
|        |           | Adolescents |             |             |             | Parents |          |    |      | Adolescents          |          |    |      | Parents |          |    |      | Adolescents     |          |    |      | Parents |             |             |             |
|        |           | $\beta$     | <i>p</i>    | BY          | BH          | $\beta$ | <i>p</i> | BY | BH   | $\beta$              | <i>p</i> | BY | BH   | $\beta$ | <i>p</i> | BY | BH   | $\beta$         | <i>p</i> | BY | BH   | $\beta$ | <i>p</i>    | BY          | BH          |
| E<br>S | Diff. 7_5 | -0.09       | .359        | 1           | .687        | 0.12    | .141     | 1  | .539 | -0.12                | .247     | 1  | .623 | 0.08    | .274     | 1  | .649 | -0.06           | .158     | 1  | .571 | -0.08** | <b>.005</b> | <b>.614</b> | <b>.382</b> |
|        | Diff. 9_5 | -0.14       | .150        | 1           | .561        | 0.10    | .195     | 1  | .590 | -0.14                | .166     | 1  | .581 | -0.01   | .854     | 1  | .941 | -0.03           | .503     | 1  | .738 | -0.02   | .501        | 1           | .738        |
|        | Diff. 9_7 | -0.05       | .398        | 1           | .694        | -0.02   | .804     | 1  | .911 | -0.03                | .699     | 1  | .857 | -0.09   | .200     | 1  | .590 | 0.03            | .426     | 1  | .705 | 0.06    | .050        | 1           | .382        |
| E      | Diff. 7_5 | -0.07       | .296        | 1           | .649        | 0.07    | .281     | 1  | .649 | 0.03                 | .709     | 1  | .861 | 0.05    | .362     | 1  | .687 | -0.02           | .555     | 1  | .766 | -0.06** | <b>.008</b> | <b>.798</b> | <b>.130</b> |
|        | Diff. 9_5 | -0.20**     | <b>.004</b> | <b>.614</b> | <b>.100</b> | 0.03    | .610     | 1  | .797 | -0.05                | .501     | 1  | .738 | 0.04    | .458     | 1  | .723 | -0.00           | .935     | 1  | .981 | -0.01   | .649        | 1           | .824        |
|        | Diff. 9_7 | -0.13**     | <b>.003</b> | <b>.532</b> | <b>.087</b> | -0.04   | .468     | 1  | .729 | -0.08                | .103     | 1  | .489 | -0.01   | .840     | 1  | .933 | 0.02            | .554     | 1  | .766 | 0.05    | .040        | 1           | .335        |
| O      | Diff. 7_5 | -0.10       | .326        | 1           | .653        | 0.08    | .305     | 1  | .649 | -0.14                | .197     | 1  | .590 | -0.01   | .929     | 1  | .981 | -0.04           | .276     | 1  | .649 | -0.02   | .474        | 1           | .734        |
|        | Diff. 9_5 | -0.13       | .229        | 1           | .614        | 0.09    | .304     | 1  | .649 | -0.19                | .075     | 1  | .413 | -0.07   | .360     | 1  | .687 | 0.02            | .689     | 1  | .857 | 0.01    | .781        | 1           | .891        |
|        | Diff. 9_7 | -0.03       | .743        | 1           | .880        | 0.00    | .983     | 1  | .992 | -0.06                | .445     | 1  | .723 | -0.07   | .432     | 1  | .706 | 0.06            | .118     | 1  | .491 | 0.03    | .377        | 1           | .690        |
| A      | Diff. 7_5 | -0.19       | .035        | 1           | .314        | -0.03   | .739     | 1  | .880 | -0.13                | .133     | 1  | .516 | 0.08    | .344     | 1  | .672 | -0.04           | .231     | 1  | .602 | -0.02   | .566        | 1           | .770        |
|        | Diff. 9_5 | -0.27**     | <b>.003</b> | <b>.532</b> | <b>.087</b> | 0.01    | .936     | 1  | .981 | -0.17                | .063     | 1  | .400 | 0.03    | .692     | 1  | .857 | -0.04           | .245     | 1  | .623 | -0.04   | .223        | 1           | .607        |
|        | Diff. 9_7 | -0.07       | .294        | 1           | .649        | 0.04    | .646     | 1  | .824 | -0.04                | .500     | 1  | .738 | -0.05   | .543     | 1  | .766 | -0.00           | .965     | 1  | .987 | -0.02   | .505        | 1           | .738        |
| C      | Diff. 7_5 | -0.07       | .313        | 1           | .651        | 0.01    | .837     | 1  | .933 | 0.02                 | .811     | 1  | .913 | 0.01    | .821     | 1  | .920 | 0.00            | .957     | 1  | .987 | 0.01    | .494        | 1           | .738        |
|        | Diff. 9_5 | -0.15       | .053        | 1           | .394        | -0.03   | .579     | 1  | .776 | -0.07                | .394     | 1  | .694 | -0.08   | .157     | 1  | .571 | 0.01            | .781     | 1  | .891 | 0.01    | .756        | 1           | .885        |
|        | Diff. 9_7 | -0.07       | .206        | 1           | .595        | -0.05   | .388     | 1  | .694 | -0.09                | .074     | 1  | .413 | -0.09   | .081     | 1  | .413 | 0.01            | .777     | 1  | .891 | -0.01   | .736        | 1           | .880        |

Note. Diff 5\_7, 5\_9, and 7\_9 describe the effects for differences between the respective grades 5, 7, and 9. All effects were controlled for gender, IQ, socioeconomic status, and immigration status. *p* = unadjusted *p*-value, BH = adjusted *p*-value after Benjamini & Hochberg (FDR), BY = adjusted *p*-value after Benjamini & Yekutieli. Bold values indicate different decisions based on the unadjusted compared to the adjusted *p*-values. N = 2,667.

\*\* *p* < .01. \*\*\* *p* < .001.

Table OS 18

Standardized Regression Effects of Differences between Self- and Parent-Reported Personality-Achievement-Associations in Grades 5, 7, and 9 Including Unadjusted and Adjusted *p*-Values

|    |         | German school grade |          |      |      | Mathematics school grade |             |             |      | Reading competence |             |             |             | Mathematics competence |          |      |      |
|----|---------|---------------------|----------|------|------|--------------------------|-------------|-------------|------|--------------------|-------------|-------------|-------------|------------------------|----------|------|------|
|    |         | $\beta$             | <i>p</i> | BY   | BH   | $\beta$                  | <i>p</i>    | BY          | BH   | $\beta$            | <i>p</i>    | BY          | BH          | $\beta$                | <i>p</i> | BY   | BH   |
| ES | Grade 5 | /                   | /        | /    | /    | /                        | /           | /           | /    | 12.89**            | <b>.010</b> | <b>.335</b> | <b>.061</b> | 11.19                  | .013     | .394 | .071 |
|    | Grade 7 | 0.16                | .139     | 1    | .333 | 0.05                     | .669        | 1           | .789 | 7.42**             | <b>.003</b> | <b>.134</b> | .024        | 4.06                   | .117     | 1    | .294 |
|    | Grade 9 | 0.04                | .613     | 1    | .776 | -0.06                    | .562        | 1           | .735 | 1.68               | .468        | 1           | .630        | 3.32                   | .143     | 1    | .333 |
| E  | Grade 5 | /                   | /        | /    | /    | /                        | /           | /           | /    | 9.39               | .015        | .440        | .080        | 6.21                   | .075     | 1    | .255 |
|    | Grade 7 | 0.32***             | <.001    | .022 | .004 | 0.27**                   | <b>.006</b> | <b>.221</b> | .040 | 5.38               | .013        | .391        | .071        | 2.89                   | .199     | 1    | .392 |
|    | Grade 9 | 0.05                | .428     | 1    | .604 | -0.01                    | .870        | 1           | .929 | -0.14              | .936        | 1           | .959        | -0.02                  | .992     | 1    | .992 |
| O  | Grade 5 | /                   | /        | /    | /    | /                        | /           | /           | /    | 4.72               | .357        | 1           | .543        | 6.53                   | .163     | 1    | .352 |
|    | Grade 7 | 0.15                | .167     | 1    | .352 | 0.15                     | .194        | 1           | .389 | 2.99               | .294        | 1           | .473        | 4.84                   | .085     | 1    | .264 |
|    | Grade 9 | 0.12                | .276     | 1    | .466 | 0.13                     | .293        | 1           | .473 | -0.73              | .780        | 1           | .874        | -1.88                  | .467     | 1    | .630 |
| A  | Grade 5 | /                   | /        | /    | /    | /                        | /           | /           | /    | 5.16               | .233        | 1           | .430        | 4.29                   | .276     | 1    | .466 |
|    | Grade 7 | 0.14                | .254     | 1    | .455 | 0.18                     | .156        | 1           | .352 | 4.87               | .086        | 1           | .264        | 4.07                   | .137     | 1    | .333 |
|    | Grade 9 | 0.11                | .217     | 1    | .410 | 0.03                     | .816        | 1           | .900 | 3.34               | .204        | 1           | .392        | 2.78                   | .221     | 1    | .413 |
| C  | Grade 5 | /                   | /        | /    | /    | /                        | /           | /           | /    | 5.57               | .113        | 1           | .294        | 5.88                   | .070     | 1    | .249 |
|    | Grade 7 | 0.04                | .621     | 1    | .776 | 0.04                     | .698        | 1           | .815 | 2.18               | .261        | 1           | .460        | 2.17                   | .298     | 1    | .474 |
|    | Grade 9 | 0.02                | .802     | 1    | .892 | 0.04                     | .652        | 1           | .789 | 1.93               | .287        | 1           | .472        | 0.20                   | .901     | 1    | .942 |

Note. Effects for rater differences school grades are not included in the analysis because of high proportions of missing data. All effects were controlled for gender, IQ, socioeconomic status, and immigration status. *p* = unadjusted *p*-value, BH = adjusted *p*-value after Benjamini & Hochberg (FDR), BY = adjusted *p*-value after Benjamini & Yekutieli. Bold values indicate different decisions based on the unadjusted compared to the adjusted *p*-values. N = 2,667.

\*\* *p* < .01. \*\*\* *p* < .001.

**Table OS 19**

*Standardized Regression Effects of Differences between Self- and Parent-Reported Personality-Social-Relationship-Associations in Grades 5, 7, and 9 Including Unadjusted and Adjusted p-Values*

|    |         | Helpfulness |          |      |      | Aggressiveness |          |      |      | Teacher-student-relationship |             |             |      |
|----|---------|-------------|----------|------|------|----------------|----------|------|------|------------------------------|-------------|-------------|------|
|    |         | $\beta$     | <i>p</i> | BY   | BH   | $\beta$        | <i>p</i> | BY   | BH   | $\beta$                      | <i>p</i>    | BY          | BH   |
| ES | Grade 5 | 0.13        | .104     | 1    | .286 | -0.14          | .092     | 1    | .270 | 0.20                         | .059        | 1           | .216 |
|    | Grade 7 | -0.04       | .349     | 1    | .537 | 0.01           | .839     | 1    | .917 | 0.10                         | .118        | 1           | .294 |
|    | Grade 9 | -0.07       | .202     | 1    | .392 | -0.00          | .939     | 1    | .959 | -0.01                        | .893        | 1           | .940 |
| E  | Grade 5 | 0.13        | .038     | .818 | .148 | -0.04          | .507     | 1    | .670 | 0.26**                       | <b>.003</b> | <b>.134</b> | .024 |
|    | Grade 7 | 0.02        | .654     | 1    | .432 | -0.10          | .024     | .560 | .101 | 0.05                         | .393        | 1           | .579 |
|    | Grade 9 | -0.04       | .410     | 1    | .592 | -0.03          | .319     | 1    | .496 | 0.01                         | .919        | 1           | .953 |
| O  | Grade 5 | 0.09        | .263     | 1    | .460 | -0.03          | .768     | 1    | .867 | 0.26                         | .035        | .774        | .140 |
|    | Grade 7 | 0.04        | .399     | 1    | .581 | -0.10          | .079     | 1    | .258 | 0.02                         | .744        | 1           | .854 |
|    | Grade 9 | 0.03        | .621     | 1    | .776 | -0.10          | .049     | 1    | .185 | 0.05                         | .608        | 1           | .776 |
| A  | Grade 5 | 0.12        | .115     | 1    | .294 | 0.02           | .849     | 1    | .919 | 0.24                         | .024        | .560        | .101 |
|    | Grade 7 | 0.07        | .154     | 1    | .352 | -0.00          | .984     | 1    | .992 | 0.06                         | .480        | 1           | .640 |
|    | Grade 9 | -0.03       | .630     | 1    | .781 | -.008          | .116     | 1    | .294 | 0.10                         | .169        | 1           | .352 |
| C  | Grade 5 | -0.01       | .853     | 1    | .919 | -0.01          | .890     | 1    | .940 | 0.13                         | .087        | 1           | .264 |
|    | Grade 7 | 0.04        | .238     | 1    | .432 | 0.04           | .383     | 1    | .575 | -0.02                        | .670        | 1           | .789 |
|    | Grade 9 | 0.04        | .386     | 1    | .575 | -0.02          | .646     | 1    | .789 | -0.00                        | .946        | 1           | .959 |

*Note.* All effects were controlled for gender, IQ, socioeconomic status, and immigration status. *p* = unadjusted *p*-value, BH = adjusted *p*-value after Benjamini & Hochberg (FDR), BY = adjusted *p*-value after Benjamini & Yekutieli. Bold values indicate different decisions based on the unadjusted compared to the adjusted *p*-values. N = 2,667.

\*\* *p* < .01. \*\*\* *p* < .001.

Table OS 20

Standardized Regression Effects of Differences between Self- and Parent-Reported Personality-Adjustment-Associations in Grades 5, 7, and 9 Including Unadjusted and Adjusted *p*-Values

|    |         | Self-esteem |             |             |       | Well-being in school |             |             |      | Health problems |          |      |      |
|----|---------|-------------|-------------|-------------|-------|----------------------|-------------|-------------|------|-----------------|----------|------|------|
|    |         | $\beta$     | <i>p</i>    | BY          | BH    | $\beta$              | <i>p</i>    | BY          | BH   | $\beta$         | <i>p</i> | BY   | BH   |
| ES | Grade 5 | 0.51***     | <.001       | <.001       | <.001 | 0.28**               | <b>.007</b> | <b>.252</b> | .046 | 0.04            | .271     | 1    | .466 |
|    | Grade 7 | 0.30***     | <.001       | <.001       | <.001 | 0.09                 | .182        | 1           | .370 | 0.06            | .023     | .560 | .101 |
|    | Grade 9 | 0.27***     | <.001       | <.001       | <.001 | 0.15                 | .011        | .357        | .065 | 0.03            | .310     | 1    | .488 |
| E  | Grade 5 | 0.39***     | <.001       | <.001       | <.001 | 0.21**               | <b>.008</b> | <b>.269</b> | .049 | 0.01            | .716     | 1    | .829 |
|    | Grade 7 | 0.23***     | <.001       | .002        | <.001 | 0.19***              | <.001       | .019        | .003 | 0.05            | .027     | .612 | .111 |
|    | Grade 9 | 0.14**      | <b>.001</b> | <b>.075</b> | .014  | 0.12**               | <b>.003</b> | <b>.134</b> | .024 | 0.02            | .431     | 1    | .604 |
| O  | Grade 5 | 0.42***     | <.001       | .008        | .002  | 0.24                 | .022        | .560        | .101 | 0.07            | .071     | 1    | .249 |
|    | Grade 7 | 0.23**      | <b>.001</b> | <b>.075</b> | .014  | 0.11                 | .100        | 1           | .282 | 0.04            | .101     | 1    | .282 |
|    | Grade 9 | 0.21**      | <b>.001</b> | <b>.075</b> | .014  | 0.12                 | .077        | 1           | .256 | 0.08            | .020     | .543 | .098 |
| A  | Grade 5 | 0.38***     | <.001       | .008        | .001  | 0.23                 | .018        | .500        | .091 | 0.05            | .143     | 1    | .333 |
|    | Grade 7 | 0.22**      | <b>.002</b> | <b>.078</b> | .014  | 0.02                 | .752        | 1           | .856 | 0.02            | .414     | 1    | .592 |
|    | Grade 9 | 0.11        | .089        | 1           | .264  | 0.03                 | .615        | 1           | .776 | 0.04            | .164     | 1    | .352 |
| C  | Grade 5 | 0.27***     | <.001       | .019        | .003  | 0.06                 | .451        | 1           | .625 | 0.02            | .467     | 1    | .630 |
|    | Grade 7 | 0.18***     | <.001       | .008        | .002  | 0.06                 | .180        | 1           | .370 | 0.01            | .666     | 1    | .789 |
|    | Grade 9 | 0.15**      | <b>.001</b> | <b>.070</b> | .013  | 0.06                 | .163        | 1           | .352 | 0.02            | .282     | 1    | .470 |

Note. All effects were controlled for gender, IQ, socioeconomic status, and immigration status. *p* = unadjusted *p*-value, BH = adjusted *p*-value after Benjamini & Hochberg (FDR), BY = adjusted *p*-value after Benjamini & Yekutieli. Bold values indicate different decisions based on the unadjusted compared to the adjusted *p*-values. N = 2,667.

\*\* *p* < .01. \*\*\* *p* < .001.







# *Chapter 3*

## **Study 2**

The Longitudinal Association Between Personality and Achievement in Adolescence: Differential Effects Across all Big Five Traits and Four Achievement Indicators

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The official citation that should be used in referencing this material is:

Israel, A., Lüdtke, O., & Wagner, J. (2019). The longitudinal association between personality and achievement in adolescence: Differential effects across all Big Five traits and four achievement indicators. *Learning and Individual Differences*, 72, 80–91. <https://doi.org/10.1016/j.lindif.2019.03.001>

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### **Abstract**

In this study, we investigated the longitudinal interplay between personality and achievement and the effect of family cohesion on relative change in personality and achievement in adolescence. Using longitudinal data from the National Educational Panel Study (NEPS;  $N=4,355$ ,  $\text{Age}_{T1}=12.9$  years, 49% female adolescents), we estimated latent cross-lagged panel models that included personality traits, different achievement indicators, and family cohesion. There were three main findings. First, we replicated previous cross-sectional personality-achievement associations. Second, after accounting for covariates and stability effects, all personality traits (except agreeableness) were related to change in at least one achievement indicator. Third, student-rated family cohesion was associated with better grades (in German) 2 years later but showed no effects on personality change. The findings demonstrate that, when explored longitudinally, personality shows only small effects on achievement change and vice versa in adolescence. We emphasize the need for further research to disentangle the specific processes behind these associations.

*Keywords:* personality change, school achievement, longitudinal data, adolescence, family cohesion



### **The Longitudinal Association Between Personality and Achievement in Adolescence: Differential Effects Across All Big Five Traits and Four Achievement Indicators**

Recent studies have shown that personality (i.e., relatively stable, automatic patterns of human thinking, feeling, and behaving; Roberts, 2009) plays an important role in determining achievement outcomes in adolescence (often defined as ages 12 to 17; Soto, John, Gosling, & Potter, 2008): Personality has been associated with grades in different domains and also with academic competence (e.g., Poropat, 2009; Spengler, Lüdtke, Martin, & Brunner, 2013). However, most findings were based on cross-sectional data, and only a few studies investigated effects of personality on later educational outcomes in adolescence. Moreover, during adolescence, personality is characterized by an indistinctive pattern of dips and increases and the lowest levels of rank-order stability in comparison with every other life phase besides childhood (Roberts & DelVecchio, 2000; Soto & Tackett, 2015). But in contrast to personality's predictive power, little attention has been paid to the factors that drive personality change in adolescence. Thus far, we do not fully understand how personality and educational achievement are interrelated across adolescence and which predictors are associated with personality changes. Besides school, the social environment of the family, where adolescents still spend large amounts of their time, has been identified as a pivotal developmental context for adolescents (Caspi, Roberts, & Shiner, 2005; Collins, Maccoby, Steinberg, Hetherington, & Bornstein, 2000; Eccles et al., 1993; Shiner & Caspi, 2003) and could therefore provide potential predictors of adolescents' development. On the basis of the rationale behind self-regulation theory (Denissen et al., 2013), we would like to argue for a broader perspective and thus the joint consideration of social and achievement-related aspects, both of which could enhance shifts in the reference values from an adolescent's environment. To address this research gap, we had three research goals here: first, to replicate existing cross-sectional findings on the association between adolescents' personality and school achievement; second, to extend the cross-sectional associations by investigating the reciprocal effects of personality on school achievement change 2 years later and vice versa; and third, to examine the role of family cohesion as a possible social context factor in personality and achievement change in adolescence. We used longitudinal data with two measurement points from a representative sample of German adolescents ( $N = 4,355$ ) from the large-scale, longitudinal National Educational Panel Study (NEPS). We investigated cross-sectional associations and reciprocal longitudinal effects between the Big Five personality traits and four academic achievement

indicators (grades and competence tests in German and math) while controlling for the stability of personality and achievement and potential influential covariates. We used both students' and parents' ratings of family cohesion to test whether different perspectives on this potential social context variable would affect personality and achievement change.

### **Cross-Sectional Findings on the Association between Personality and Academic Achievement**

Although an increasing number of empirical studies have considered predictive factors in educational settings beyond intelligence, empirical work on the role of personality in educational settings is limited, especially in adolescence. Specifically, most studies have reported cross-sectional findings or have identified personality as an important predictor of educational outcomes or success but omitted the possibility of a dynamic interaction (Chamorro-Premuzic, Harlaar, Greven, & Plomin, 2010; O'Connor & Paunonen, 2007; Poropat, 2009; Spengler, Brunner, Martin, & Lüdtke, 2016; Steinmayr & Spinath, 2007). Three meta-analyses of only cross-sectional studies showed that more open, agreeable, and conscientious individuals had higher academic outcomes (Poropat, 2009; Laidra, Pullmann, & Allik, 2007) and that students with higher levels of neuroticism had poorer grades (Laidra et al., 2007). Mixed findings emerged for relations between students' extraversion and academic achievement, ranging from null results (Laidra et al., 2007) to negative associations (Lechner, Danner, & Rammstedt, 2017; O'Connor & Paunonen, 2007; Spengler et al., 2016). Conscientiousness seems to play a particularly crucial role in educational outcomes and occupational success in adolescence (e.g., Chamorro-Premuzic & Furnham, 2003; Dumfart & Neubauer, 2016; Spengler et al., 2013; Trautwein, Lüdtke, Roberts, Schnyder, & Niggli, 2009).

Importantly, academic achievement can be measured with different indicators, namely, grades and competence or achievement tests, and they are often only modestly correlated (Borghans, Golsteyn, Heckman, & Humphries, 2016; Lechner et al., 2017). The Big Five personality traits have been found to correlate with both achievement indicators, although often with differential patterns, and both indicators have shown incremental validity with respect to intelligence (Borghans et al., 2016; Lechner et al., 2017, Rammstedt, Danner, & Lechner, 2017). For example, in two samples of adolescents from large-scale studies, openness was significantly correlated with achievement test scores, whereas conscientiousness was positively related to grades (Spengler et al., 2013).

Overall, primarily cross-sectional studies have identified significant associations between each of the Big Five personality traits and different achievement indicators but have

shown mixed findings regarding the direction of effects. Conscientiousness seems to be the strongest predictor of grades, whereas openness seems to predict achievement test scores.

### **Personality as a Predictor of Achievement Development in Adolescence**

The few longitudinal studies that have examined both personality and achievement have usually predicted later achievement from personality, but only the study by Spengler et al. (2016) actually controlled for prior achievement levels (i.e., stability). Similar to the cross-sectional findings, results of the longitudinal studies were inconsistent across studies with the exception of the findings on conscientiousness: Higher conscientiousness in adolescence predicted better grades in different subjects several years later (e.g., Chamorro-Premuzic & Furnham, 2003; Heaven & Ciarrochi, 2008; Spengler et al., 2016). In a prospective longitudinal cohort study, Prevoe and ter Weel (2015) were even able to show that conscientiousness at age 16 predicted important socioeconomic outcomes (e.g., employment and wages) 18 years later and that a decline in conscientiousness from age 10 to 16 had negative effects on most of the investigated outcomes. Thus, both level and change in conscientiousness appeared to be related to achievement variables later on. Finally, in one of the few longitudinal studies conducted in the school context, Spengler et al. (2016) not only included achievement variables differentiated by school subjects but also controlled for prior achievement. Besides the positive general effect of conscientiousness on grades, openness and extraversion had only subject-specific effects. Interestingly, personality did not show predictive validity for changes in grades when prior grades were controlled for.

Overall, longitudinal studies exploring the effects of personality on achievement are rare, but existing studies have again underlined the crucial role of conscientiousness. Also noteworthy, most studies focused on conscientiousness and did not include the four other traits.

### **Achievement as a Possible Predictor of Personality Development in Adolescence**

Past research on personality development in adolescence has paid little attention to the role of educational achievement but has primarily referred to two challenges during this time: (a) internal identity processes and (b) changing personal goals and social norms (Denissen, van Aken, Penke, & Wood, 2013; Erikson, 1959; Marcia, 1980). Focusing on identity processes, Erikson (1959) described identity formation as the key developmental task of adolescence. The way adolescents replace or reinterpret childhood identifications and form their own commitments are likely to lead to changes in personality dimensions (Hill & Edmonds, 2017; Klimstra, 2013; Marcia, 1980). Focusing on self-regulative processes, self-regulation theory

(Denissen et al., 2013) has gained increasing attention in research on personality development in adolescence. Self-regulation theory proposes that adolescents are confronted with shifts in reference values, which are triggered, for example, by social or demographic transitions (e.g., puberty). These new reference values require new behavioral and regulatory abilities that will also manifest in personality change and might contribute to the nonlinear change trajectories and lower stability found in adolescents' personality development (Denissen et al., 2013; Hill & Edmonds, 2017; Shiner & Caspi, 2003).

To be a good and successful student (i.e., to exhibit high educational achievement) is one major expectation in adolescence that is most likely related to both identity formation and self-regulatory processes and, thus, to personality development in adolescence. That is, high academic achievement could be seen as one possible feedback loop by which to develop and integrate new personal goals and social norms as part of either the identity formation process or the self-regulatory process. If both of these processes are at the fundament of personality development in adolescence, personality should be susceptible to changing on the basis of (feedback from) grades and competence tests. To date, only a few studies have investigated whether school achievement, in terms of grades or achievement tests, is related to personality change in adolescence, while controlling for initial personality levels.

We are aware of only two studies with a similar research question, one using an older adolescent sample and one a young adult sample: First, relying on the traditional Big Five personality structure, Bleidorn (2012) investigated high school students during their transition from school to adult life. She found that changes in self-reported achievement investment behaviors and attitudes were associated with changes in neuroticism, extraversion, openness, and conscientiousness. Second, focusing on work-related achievement variables in a sample of young adults, Roberts, Caspi, and Moffit (2003) showed that high-status attainment at work at age 18 predicted a more mature personality at age 26 (e.g., less anxious and more confident). Thus, results of these two studies indicate that self-reported achievement attitudes interact with personality development in this transition. However, still unknown is whether more objective academic achievement variables (e.g., grades and competence tests) are associated with personality change in adolescence.

### **The Importance of Family Cohesion**

Family environment still plays an important role in adolescents' social behavior (Ackard, Neumark-Sztainer, Story, & Perry, 2006; Johnson, LaVoie, & Mahoney, 2001; Lucia & Breslau, 2006) and is also associated with personality (Branje, van Lieshout, & van Aken,



2004; Syed & Seiffge-Krenke, 2013; van den Akker, Deković, Asscher, Prinzie, 2014) and students' academic achievement (e.g., Castro et al., 2015; Hill & Tyson, 2009; Karbach, Gottschling, Spengler, Hegewald, & Spinath, 2013; Pinquart, 2016; Spera, 2005). Because students still live at home, it is likely that they are also confronted with expectations held by their parents, who, for example, want their adolescent children to be more responsible, autonomous, and cooperative at home as well as in school. These new reference values could be another catalyst for the self-regulatory processes that again enhance personality development and identity formation. We concentrated on one specific indicator of a supportive family and a good parent-child relationship, namely, family cohesion (Moos & Moos, 1981; Wentzel, 1998), which might be an indicator of the ability to successfully handle these expectations. Family cohesion is described as feelings of closeness, belonging, and acceptance in a family (Johnson et al., 2001; McKeown et al., 1997).

Little research has linked family cohesion with Big Five personality development. Syed and Seiffge-Krenke (2013) showed that providing a warm and supportive family environment in general was not related to the development of a more mature personality, in the form of ego development, whereas supporting the personal growth of adolescents was related to ego development in the following years. In a more classical Big Five personality tradition, Branje et al. (2004) illustrated that change in perceptions of support in families were most consistently related to change in agreeableness. Furthermore, initial levels of personality predicted changes in a person's own and family members' perceptions of support, but initial levels of support did not predict personality change. In another longitudinal study, van den Akker et al. (2014) investigated bidirectional associations between children's personality and parenting behavior. Among other findings, their results showed that an increase in parental warmth was associated with an increase in children's conscientiousness. However, the reported effect sizes were generally small, and the results provided stronger support for the effect of personality on change in parenting behavior than vice versa.

A stronger research tradition exists with respect to the family effects on academic achievement. Meta-analyses have reported consistent positive effects of parental involvement, more precisely the development of consistent communication about school (Castro et al., 2015), academic socialization (Hill & Tyson, 2009), and parental warmth and autonomy (Pinquart, 2016) on academic achievement. By contrast, Karbach et al. (2013) found that instead of autonomy support, achievement-oriented control and structure in families incrementally predicted academic achievement in math and language domains over general cognitive ability. Thus, the type of parental involvement and other more specific family

constructs (e.g., family support, parental warmth, and achievement-oriented control) seem to be important, but these studies usually used cross-sectional data, and thus, longitudinal research is still needed.

Taken together, there is some evidence of positive effects of a supportive, warm, and engaged family, primarily on academic achievement outcomes and less so on personality in adolescence.

### **The Present Study**

We focused on three primary research goals. Our first goal was to replicate the cross-sectional findings on the associations between the Big Five and four types of achievement indicators, namely, self-reported German and math grades plus objective spelling and math achievement test scores. Previous studies have illustrated general and differential associations between the Big Five and achievement as a function of different academic outcome indicators (e.g., grades vs. competence tests; Spengler et al., 2013). That is, in line with previous research, we expected that conscientiousness would be strongly positively related to grades and openness would show positive associations with competence test scores. Neuroticism was viewed as a vulnerability factor and was thus expected to be related to lower achievement outcomes overall. Finally, extraversion and agreeableness were not expected to be related to results from objective competence tests, but they were expected to be related to self-reported grades.

Our second research goal was to investigate the longitudinal associations between personality and achievement. In particular, we aim to extend the current picture by examining the reciprocal effects of different achievement indicators on relative personality change (i.e., change in interindividual differences) across two measurement points spaced 2 years apart. Because only a few longitudinal studies exist in this research domain, our hypotheses had to be largely based on previous cross-sectional findings. In line with these cross-sectional studies, we expected similar patterns in longitudinal associations between personality and relative change in achievement 2 years later. Given that even fewer longitudinal studies have considered effects that work in the other direction, the analyses containing personality change as the outcome were considered exploratory.

Our third research goal was to examine family cohesion as another potential predictor of relative change in personality and achievement during adolescence. Good family cohesion might provide an important resource for coping with the developmental tasks of adolescence (Heerde, Toumbourou, Hemphill, & Olsson, 2015; Karbach et al., 2013). For achievement change, we expected that a report of stronger cohesion would be related to better academic

achievement measured 2 years later. Because only a little previous research exists, analyses with respect to personality were again considered exploratory. Finally, we were able to investigate these associations from the perspective of two raters because family cohesion was reported by both students and by their parents.

## Method

### Sample

Analyses were applied to the Starting Cohort 3 of the National Educational Panel Study (NEPS). The NEPS is a German cross-sequential study that focuses on educational processes and the development of competencies across the lifespan (for details, see Blossfeld, Roßbach, & von Maurice, 2011). Students in this Starting Cohort 3 were first assessed in Grade 5 (2010/11) and had annual follow-ups. The current study used data only from Grades 7 (2012/13) and 9 (2014/15) because personality was assessed at only these two time points. We selected achievement variables in accordance with these two measurement points and included German and math grades as well as spelling and mathematical competence tests. The original sample size was 5,252, including both measurement points and containing all relevant variables for the analyses. We had two selection criteria for our final sample: First, students had to have at least one valid answer for one personality item or one achievement indicator ( $n = 418$  had no personality or achievement data). Second, to be able to adjust our analyses for the hierarchical structure (students nested in schools), we included only students who had an existing school ID ( $n = 479$  had no ID information in the data set).

Our final sample ( $N = 4,355$ , 49% female adolescents) consisted of students in Grade 7 (age:  $M = 12.9$ ,  $SD = 0.49$ ) at the first measurement point recruited from 277 different schools from all over Germany. More than half of the students (52%) attended a German academic track school (see Maaz, Trautwein, Lüdtke, & Baumert, 2008, for a detailed description of the German school system). Furthermore, we included data from  $N = 3,830$  parents who rated family cohesion in Grade 7.

Two measurement points with personality data existed for  $N = 3,518$  of the participants. Between the Grade 7 and 9 assessments, approximately 16% of the students dropped out of the study ( $N = 708$ ), whereas 129 students took part only at T2. Longitudinal selectivity analyses indicated that drop outs were more likely to be male (Cohen's  $d = -0.18$ ), were slightly older ( $d = 0.18$ ), were less likely to be enrolled in an academic track school ( $d = -0.17$ ), did not differ with respect to migration background, had parents with fewer years of education ( $d = -0.15$ ),

and reported lower family cohesion ( $d = -0.18$ ). However, parents' perception of family cohesion did not differ between the two groups. The two samples also differed on all achievement indicators (from  $d = -0.25$  for German grades to  $d = -0.34$  for spelling competence) as well as in agreeableness ( $d = -0.13$ ) and conscientiousness ( $d = -0.17$ ). There were no differences in neuroticism, extraversion, or openness. The existing differences between the two groups indicated a small degree of selectivity. To adjust for these small differences, covariates were included in all models.

## Measures

### *Personality*

In Grades 7 and 9, personality was assessed with the BFI-10 (Rammstedt & John, 2007), a short, well-validated, and efficient 10-item version of the Big Five Inventory. The BFI-10 is often used in large-scale studies (Credé, Harms, Niehorster, & Gaye-Valentine, 2012; Spengler, Lüdtke, Martin, & Brunner, 2013). It measures each personality trait with two items, one of which is negatively worded and thus reverse-scored. Agreeableness was the only exception and was assessed with an additional third item, as recommended by Rammstedt and John (2007; see also Wohlkinger, Ditton, von Maurice, Haugwitz, & Blossfeld, 2011). Students rated their personality characteristics on 5-point Likert scales (1 = *does not apply at all* to 5 = *fully applies*). Cronbach's alphas for the five personality scales were: .34/.46 (T1/T2) for neuroticism, .43/.63 for extraversion, .38/.47 for openness, .39/.40 for agreeableness, and .53/.52 for conscientiousness. Such internal consistencies are in line with previous research in this age group (Roberts & DelVecchio, 2000; Spengler et al., 2013) and were expected due to the small number of items per trait. Furthermore, the BFI-10 was shown to be valid for investigating the relations between personality and academic achievement (Credé et al. 2012).

### *Academic Achievement*

We used four different indicators of academic achievement: self-reported German and math grades from the last end-of-year school report and standardized achievement tests for spelling and mathematics. Grades were coded so that higher values reflected higher achievement, with grades ranging from 1 (*insufficient*) to 6 (*very good*). Self-reported grades can be considered reliable and valid indicators of achievement (Dickhäuser & Plenter, 2005; Sanchez & Buddin, 2015). The NEPS used a spelling test that had previously been designed for fourth and fifth graders (Frahm et al., 2011; Voss, Blatt, & Kowalski, 2007). During the course of the NEPS, the test was developed further so that it retained the same framework but

used different content (Blatt, Jarsinski, & Prosch, 2017; Frahm et al., 2011). The applied mathematics competence test is based on the idea of mathematical literacy (as also used in PISA; see OECD, 2003) and measures the ability to flexibly use and apply mathematics in realistic situations. The framework of the test distinguishes between a “content areas” dimension, which represents the field of mathematics, and a “cognitive components” dimension, which refers to the cognitive processes that are necessary to solve the mathematical problems. Each task is part of one content area (e.g., “quantity,” which refers to using numbers to solve problems) and requires certain cognitive components from mathematical processes (e.g., “arguing,” which refers to assessing and developing explanations and proofs). Further descriptions of the framework and test development can be found in Weinert et al. (2011), Neumann et al. (2013), and Ehmke et al. (2009). Item response theory (IRT) models were used to scale the items from the achievement tests (spelling and math). NEPS provides Weighted Likelihood Estimates (WLEs; Warm, 1989) as estimates of individual student ability. Higher WLE values indicate higher competence scores. The reliabilities of the spelling competence test in Grades 7 and 9 were very good (WLE reliability = .94 in both Grades; Blatt et al., 2017). The reliability of the mathematics competence test in Grade 7 and 9 were good (WLE reliability Grade 7/Grade 9 = .72/.81; Schnittjer & Gerken, 2017; Van den Ham, Schnittjer, & Gerken, 2018).

### ***Family Cohesion***

Family cohesion was examined with five items from the family cohesion subscale of the well-established Family Environment Scale (FES; Moos & Moos, 1981; German version: Schneewind, 1987) and was available only in Grade 7. Family cohesion describes the support and degree of commitment in a family (example item: “In our family, there is strong cohesion”). Students and one parent (84% mothers) provided ratings of the same items on a 5-point Likert scale (1 = *does not apply at all* to 5 = *fully applies*). One negatively worded item was reverse-keyed so that a mean cohesion rating could be calculated with higher scores indicating higher levels of cohesion. Reliabilities were satisfactory ( $\alpha = .76$  students;  $\alpha = .65$  parents).

### ***Covariates***

The inclusion of covariates was based on three criteria: first, the importance illustrated in previous research (Feingold, 1994; Ma & Klinger, 2000); second, substantial associations with the constructs of interest; third, significant predictors of sample selectivity in our study. On the basis of these criteria, we included three additional dummy-coded and one continuous

control variable in our models: gender (1 = female vs. 0 = male), school type<sup>1</sup> (academic track / the German “Gymnasium” = 1 vs. 0 = nonacademic track), migration background (1 = student was born in a country other than Germany vs. 0 = country of birth was Germany) and parents’ years of education (ranging from 9 to 18 years).

Table 1 presents the intercorrelations of all variables at T1. Tables OS1 and OS2 in the Online Supplement provide descriptive statistics and intercorrelations for all variables at T1 and T2.

**Table 1***Correlation Matrix of All Variables of Interest at T1*

|                                 | 1      | 2     | 3     | 4     | 5     | 6      | 7      | 8      | 9      | 10    | 11    | 12   | 13    | 14     |
|---------------------------------|--------|-------|-------|-------|-------|--------|--------|--------|--------|-------|-------|------|-------|--------|
| 1. Neuroticism                  |        |       |       |       |       |        |        |        |        |       |       |      |       |        |
| 2. Extraversion                 | -.23** |       |       |       |       |        |        |        |        |       |       |      |       |        |
| 3. Openness                     | .01    | .08** |       |       |       |        |        |        |        |       |       |      |       |        |
| 4. Agreeableness                | -.01   | .02   | .18** |       |       |        |        |        |        |       |       |      |       |        |
| 5. Conscientiousness            | -.04** | .00   | .11** | .31** |       |        |        |        |        |       |       |      |       |        |
| 6. German grade                 | -.02   | .08** | .13** | .09** | .23** |        |        |        |        |       |       |      |       |        |
| 7. Math grade                   | -.08** | .00   | .00   | .04   | .15** | .46**  |        |        |        |       |       |      |       |        |
| 8. Spelling competence          | -.03   | .08** | .11** | .05** | .13** | .46**  | .22**  |        |        |       |       |      |       |        |
| 9. Mathematics competence       | -.10** | .01   | .08** | -.03  | -.01  | .26**  | .40**  | .48**  |        |       |       |      |       |        |
| 10. Family cohesion students    | -.11** | .15** | .13** | .25** | .29** | .19**  | .12**  | .15**  | .06**  |       |       |      |       |        |
| 11. Family cohesion parents     | -.02   | .05** | .04   | .07** | .06** | .06**  | .05    | .06**  | .03    | .24** |       |      |       |        |
| 12. Gender                      | .16**  | .03   | .23** | .19** | .19** | .19**  | -.08** | .19**  | -.15** | .04   | .00   |      |       |        |
| 13. Academic track school       | -.07** | .07** | .09** | -.01  | .06** | .25**  | .18**  | .53**  | .49**  | .11** | .07** | .04  |       |        |
| 14. Migration background        | -.02   | .02   | .01   | -.02  | -.02  | -.06** | -.03   | -.08** | -.05** | -.03  | -.03  | -.04 | -.03  |        |
| 15. Parents' years of education | -.04   | .04   | .09** | .00   | .02   | .23**  | .20**  | .26**  | .31**  | .07** | .07** | .02  | .34** | -.05** |

*Note.* Grades were recoded so that higher numbers indicate better performance. The variables gender (1 = female), academic track school (1 = yes), and migration background (1 = yes) were dummy-coded.  $N = 4,355$ .

\*\*  $p < .01$ .

## Analysis Strategy

To address our first research goal about replicating the cross-sectional associations between personality and achievement, we calculated hierarchical multiple regressions for each achievement outcome separately in R (Version 3.5.1) at T1. In a first step, we included all personality traits as predictors of the respective achievement indicator as the outcome. In a second step, we added the covariates.

To address the second research goal regarding reciprocal associations across time, we estimated latent cross-lagged panel analyses with Mplus Version 7.4 (Muthén & Muthén, 1998-2015). However, estimating latent personality traits by controlling for unreliability with very short personality scales is not straightforward because the usual internal consistency measures of reliability (e.g., Cronbach's alpha), which confound random error and item-specific variance, might not be adequate for providing a realistic estimate of a scale's reliability (Green, 2003). Therefore, we adopted an alternative strategy for obtaining reliability estimates for the short measures of the Big Five, which can be found in Table 2. This strategy does not consider the specific variance of an item to be error variance (McCrae, Kurtz, Yamagata, & Terracciano, 2011)<sup>2</sup>. Using these estimates of error variance, we controlled for unreliability by using a single-indicator approach in our cross-lagged models (Westfall & Yarkoni, 2016).

**Table 2**  
*The Estimated Error Variances, Internal Consistencies, and Reliabilities of the Big Five*

| Trait             | Personality models for the estimation of the error variances |          |          |           |      |       |      | Cronbach's $\alpha$ | Reliability |
|-------------------|--|----------|----------|-----------|------|-------|------|---------------------|-------------|
|                   | Estimate   | <i>N</i> | $\chi^2$ | <i>df</i> | CFI  | RMSEA | SRMR | T1 / T2             | T1 / T2     |
| Neuroticism       | 0.344  | 4345     | 14.272   | 3         | .987 | .029  | .024 | .34 / .46           | .50 / .54   |
| Extraversion      | 0.240  | 4341     | 94.918   | 3         | .945 | .084  | .085 | .43 / .63           | .61 / .67   |
| Openness          | 0.342  | 4344     | 43.917   | 3         | .976 | .056  | .045 | .38 / .47           | .63 / .62   |
| Agreeableness     | 0.325  | 4343     | 91.388   | 12        | .940 | .039  | .060 | .39 / .40           | .53 / .54   |
| Conscientiousness | 0.195  | 4344     | 2.583    | 3         | 1    | 0     | .011 | .53 / .52           | .67 / .66   |

*Note.* *df* = degrees of freedom; CFI = comparative fit index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual. We included a detailed explanation and description of the error variances and reliability estimation in the Online Supplement part B.

Each cross-lagged model contained three effects of interest. First, stability effects provided information about the rank-order consistency over 2 years. Second, cross-lagged effects (Campbell & Kenny, 1999; Rogosa, 1988) allowed us to disentangle the longitudinal association between personality and relative change in academic achievement and vice versa (cross-lagged paths) while controlling for initial correlations between these two constructs.



Third, correlated residuals can be interpreted as conditional correlated change (Allemand & Martin, 2016) in personality and achievement at T2, thus showing how relative changes in personality traits and in achievement indicators were associated. Therefore, in our cross-lagged models, correlated change pertains to the question of whether and to what degree change in personality traits is related to change in achievement indicators over time between individuals (Allemand & Martin, 2016). In a first step, we calculated cross-lagged models between each personality trait and each achievement variable, resulting in 20 different models (five personality traits x four achievement constructs). We controlled for our four covariates (gender, school type, migration background, and parents' years of education) in each model.

To address our third research goal, we tested for additional effects of the family by including student and parent ratings of family cohesion in the cross-lagged models. Family cohesion was assessed only at T1; thus, we could report initial correlations between all variables of interest and cross-lagged effects only on personality and achievement 2 years later.

The percentage of missing data in the personality and achievement variables varied from 3% to 10% at T1 and from 17% to 22% at T2. The percentage of missing data in the covariates varied from 0% (school type) to 13% (parents' years of education). To deal with missing values, we used the full information maximum likelihood (FIML) estimator implemented in Mplus. This estimator avoids listwise deletion of cases with missing observations and applies a model-based approach to missing data (see Enders, 2010) using all information available from the model variables to estimate the model parameters. Students in our sample were clustered in schools. Accordingly, we adjusted the standard errors for the clustered data structure (type is complex in Mplus by including the school ID as a grouping variable, see Muthén & Satorra, 1995).

## **Results**

To address our research goals, we first report the results of the cross-sectional hierarchical multiple regressions. Second, we summarize the effects of the cross-lagged models including the stability of personality and achievement, the longitudinal cross-lagged findings, and the correlated change for every combination of each Big Five factor and each of the four achievement variables. Third, we describe the effects of family cohesion on relative changes in personality and achievement.

### **Cross-Sectional Associations of Personality and Achievement**

The results of the hierarchical multiple regressions with achievement indicators as dependent variables are shown in Table 3. The first model set contains the five personality traits as predictors. In the second model set, we added the four covariates gender, academic track school, migration background, and parents' years of education.

The results of the first model set support previous findings by illustrating clear cross-sectional associations between personality traits and academic achievement: Each personality trait was predictive for at least one (agreeableness) and up to three achievement indicators (conscientiousness and openness). Replicating previous studies, conscientiousness showed consistent associations with grades but also with the spelling competence test. Openness was related to both competence test scores but also to German grades. Students with higher ratings on neuroticism reported lower mathematics achievement, a finding that was partly in line with previous studies. Whereas previous studies presented mixed findings, our results showed that extraverted and agreeable students reported better achievement in the German domain. However, when we controlled for the covariates,<sup>3</sup> six effects remained significant (at  $p < .01$ ): More conscientious seventh-grade students reported better German and math grades as well as higher spelling competencies. More open students still showed higher mathematics competencies, whereas students with higher ratings on neuroticism showed less mathematics competence. Extraversion remained positively associated with German grades and showed an additional negative effect on mathematics competence.

Together, the models largely supported previous findings, especially with respect to the positive association between conscientiousness and grades as well as between openness and competence.

**Table 3***Standardized Effects of Hierarchical Multiple Regressions with All Achievement Indicators Predicted by Personality and Covariates at T1*

|                                  | Achievement T1 |      |          |            |      |          |                     |      |          |                        |      |          |
|----------------------------------|----------------|------|----------|------------|------|----------|---------------------|------|----------|------------------------|------|----------|
|                                  | German grade   |      |          | Math grade |      |          | Spelling competence |      |          | Mathematics competence |      |          |
|                                  | $\beta$        | SE   | <i>p</i> | $\beta$    | SE   | <i>p</i> | $\beta$             | SE   | <i>p</i> | $\beta$                | SE   | <i>p</i> |
| <b>Predictors in Model Set 1</b> |                |      |          |            |      |          |                     |      |          |                        |      |          |
| Neuroticism                      | -0.00          | 0.02 | .801     | -0.07**    | 0.02 | <.001    | -0.01               | 0.03 | .708     | -0.11**                | 0.02 | <.001    |
| Extraversion                     | 0.07**         | 0.02 | <.001    | -0.02      | 0.02 | .283     | 0.08**              | 0.03 | <.001    | -0.02                  | 0.02 | .213     |
| Openness                         | 0.09**         | 0.01 | <.001    | -0.01      | 0.02 | .477     | 0.09**              | 0.02 | <.001    | 0.09**                 | 0.02 | <.001    |
| Agreeableness                    | 0.01           | 0.02 | .570     | -0.01      | 0.02 | .639     | -0.00               | 0.03 | .942     | -0.04**                | 0.03 | .006     |
| Conscientiousness                | 0.21**         | 0.02 | <.001    | 0.15**     | 0.02 | <.001    | 0.12**              | 0.03 | .000     | -0.01                  | 0.02 | .504     |
| <i>R</i> <sup>2</sup>            | .07**          |      |          | .03**      |      |          | .03**               |      |          | .02**                  |      |          |
| <b>Predictors in Model Set 2</b> |                |      |          |            |      |          |                     |      |          |                        |      |          |
| Neuroticism                      | -0.01          | 0.02 | .731     | -0.03      | 0.02 | .085     | -0.00               | 0.02 | .941     | -0.05**                | 0.02 | .001     |
| Extraversion                     | 0.06**         | 0.02 | <.001    | -0.01      | 0.02 | .439     | 0.03                | 0.02 | .018     | -0.05**                | 0.02 | .001     |
| Openness                         | 0.04           | 0.01 | .029     | -0.02      | 0.02 | .273     | 0.01                | 0.02 | .662     | 0.06**                 | 0.02 | <.001    |
| Agreeableness                    | -0.01          | 0.02 | .634     | -0.02      | 0.03 | .318     | -0.00               | 0.03 | .965     | -0.01                  | 0.03 | .377     |
| Conscientiousness                | 0.20**         | 0.02 | <.001    | 0.17**     | 0.02 | <.001    | 0.07**              | 0.02 | <.001    | -0.01                  | 0.02 | .621     |
| <b>Covariates</b>                |                |      |          |            |      |          |                     |      |          |                        |      |          |
| Gender                           | 0.13**         | 0.03 | <.001    | -0.10**    | 0.03 | <.001    | 0.16**              | 0.04 | <.001    | -0.18**                | 0.04 | <.001    |
| Academic track school            | 0.15**         | 0.03 | <.001    | 0.13**     | 0.03 | <.001    | 0.47**              | 0.04 | <.001    | 0.41**                 | 0.04 | <.001    |
| Migration background             | -0.02          | 0.08 | .134     | -0.02      | 0.09 | .166     | -0.05**             | 0.10 | .001     | -0.04                  | 0.10 | .011     |
| Parents' years of education      | 0.17**         | 0.01 | <.001    | 0.16**     | 0.01 | <.001    | 0.09**              | 0.01 | <.001    | 0.16**                 | 0.01 | <.001    |
| <i>R</i> <sup>2</sup>            | .16**          |      |          | .09**      |      |          | .32**               |      |          | .28**                  |      |          |

*Note.*  $\beta$  = standardized coefficient; SE = Standard error;  $R^2$  = Coefficient of determination. Grades were recoded so that higher numbers indicate better performance. The variables gender (1 = female), academic track school (1 = yes), and migration background (1 = yes) were dummy-coded.

\*\*  $p < .01$ .

### **The Longitudinal Interplay of Personality and Achievement**

Results of the latent cross-lagged personality and achievement models are presented in Table 4. In all reported models, we again controlled for four pivotal covariates<sup>4</sup> of middle adolescence. With respect to rank-order effects, personality showed high stability (from .71 for neuroticism and agreeableness to .85 for openness). In addition, moderate to strong stability effects were found for the achievement indicators (from .51 for math grades up to .85 for the spelling competence tests) from T1 to T2.

#### ***Cross-Lagged Effects***

To investigate the longitudinal associations between personality and achievement, we examined cross-lagged effects of personality on relative change in academic achievement and vice versa. We found a differentiated pattern for personality traits and achievement indicators with generally small effects in both directions summarized next.

**Personality effects.** Our results illustrated effects from all Big Five traits except agreeableness. In line with our expectations, conscientiousness was positively related to grades in German and math 2 years later. There were three unexpected findings. First, openness was negatively associated with math grades, meaning that students who were more open in Grade 7 achieved lower math grades in Grade 9. Second, despite the vulnerability associated with higher neuroticism at T1, students with higher levels of neuroticism had better spelling skills at T2. Third, extraversion's negative relations with math grades, mathematics competence, and spelling competence 2 years later rendered it the most consistent negative predictor of change in interindividual achievement differences.

**Achievement effects.** Cross-lagged analyses revealed two small negative effects of competence tests on personality: Students with better spelling test scores at T1 reported less extraversion at T2, and higher scores on the mathematics competence test were associated with less conscientiousness 2 years later.

**Table 4***Standardized Stability Effects, Cross-Lagged Effects, and Correlations for the Cross-Lagged Personality and Achievement Models*

|                          | Stability |         | Cross-lagged effects |     |          |         |     |          | Correlations |       |
|--------------------------|-----------|---------|----------------------|-----|----------|---------|-----|----------|--------------|-------|
|                          | P1 → P2   | A1 → A2 | P1 → A2              |     |          | A1 → P2 |     |          | ρP1A1        | ρP2A2 |
|                          |           |         | β                    | SE  | <i>p</i> | β       | SE  | <i>p</i> |              |       |
| <b>Neuroticism</b>       |           |         |                      |     |          |         |     |          |              |       |
| German grade             | .66**     | .50**   | .01                  | .02 | .561     | .02     | .03 | .445     | -.04         | -.06  |
| Math grade               | .66**     | .53**   | .04                  | .02 | .104     | -.02    | .02 | .323     | -.11**       | -.04  |
| Spelling competence      | .66**     | .77**   | .04**                | .01 | .002     | -.01    | .03 | .799     | -.04         | -.03  |
| Mathematics competence   | .66**     | .62**   | .03                  | .02 | .110     | -.05    | .03 | .061     | -.13**       | -.03  |
| <b>Extraversion</b>      |           |         |                      |     |          |         |     |          |              |       |
| German grade             | .76**     | .50**   | .03                  | .02 | .091     | -.02    | .02 | .289     | .11**        | .03   |
| Math grade               | .76**     | .52**   | -.09**               | .02 | <.001    | -.04    | .02 | .044     | -.00         | .05   |
| Spelling competence      | .77**     | .77**   | -.03**               | .01 | .008     | -.06**  | .02 | .005     | .11**        | -.00  |
| Mathematics competence   | .76**     | .62**   | -.06**               | .01 | <.001    | -.04    | .03 | .103     | .01          | -.05  |
| <b>Openness</b>          |           |         |                      |     |          |         |     |          |              |       |
| German grade             | .84**     | .50**   | .04                  | .02 | .060     | .02     | .02 | .402     | .16**        | .05   |
| Math grade               | .85**     | .52**   | -.05**               | .02 | .008     | -.02    | .02 | .409     | .01          | .04   |
| Spelling competence      | .85**     | .76**   | .01                  | .01 | .366     | -.03    | .02 | .219     | .14**        | .05   |
| Mathematics competence   | .85**     | .62**   | -.01                 | .02 | .629     | -.00    | .03 | .875     | .10**        | -.02  |
| <b>Agreeableness</b>     |           |         |                      |     |          |         |     |          |              |       |
| German grade             | .71**     | .50**   | .01                  | .02 | .770     | -.01    | .03 | .583     | .12**        | -.02  |
| Math grade               | .71**     | .52**   | -.01                 | .02 | .723     | -.04    | .03 | .112     | .05          | .00   |
| Spelling competence      | .71**     | .77**   | .01                  | .02 | .582     | .01     | .03 | .713     | .07**        | .07   |
| Mathematics competence   | .71**     | .62**   | -.03                 | .02 | .070     | -.05    | .03 | .080     | -.04         | .02   |
| <b>Conscientiousness</b> |           |         |                      |     |          |         |     |          |              |       |
| German grade             | .78**     | .48**   | .10**                | .02 | <.001    | -.02    | .02 | .335     | .27**        | .16** |
| Math grade               | .77**     | .50**   | .11**                | .02 | <.001    | -.01    | .02 | .535     | .19**        | .14** |
| Spelling competence      | .77**     | .76**   | .03                  | .01 | .013     | -.05    | .02 | .023     | .16**        | .04   |
| Mathematics competence   | .77**     | .62**   | .02                  | .02 | .135     | -.08**  | .02 | .001     | -.02         | .07   |

*Note.* P = Personality, A = Achievement, β = Standardized effect, SE = Standard error; Grades were recoded so that higher numbers indicate better performance. Effects and initial correlations were controlled for gender, attending an academic track school, migration background, and parents' years of education. The correlation between P2 and A2 can be referred to as a correlated residual or correlated change and was additionally controlled for stability and cross-lagged effects. *N* = 4,355.

\*\* *p* < .01.

### ***Correlated Change***

Our models also provided information on correlated change in personality and achievement, that is, the question of correspondence in rates of change in Big Five personality traits and achievement variables. We found correlated change only for conscientiousness: Substantial positive associations between relative change in conscientiousness and relative change in achievement occurred with respect to both German and math grades.

Taken together, these findings highlight the decisive role of conscientiousness and unexpectedly extraversion when talking about longitudinal associations between personality and achievement. They additionally show that it is necessary to distinguish between different achievement indicators also in longitudinal studies. Again, the associations were of small effect sizes.

### **Family Cohesion Effects**

To address our third research goal, we included students' and parents' ratings of family cohesion as additional predictors at T1 in all previously reported cross-lagged models. In these models, we also controlled for all covariates as reported with respect to the first two research goals. The results of the cross-lagged models are summarized in Table 5. Initial correlations of family cohesion from both perspectives with each personality trait and achievement indicator can be found in Table 1.

Results showed that students who reported better family cohesion in Grade 7 also achieved better German grades 2 years later. There were no additional effects on personality change and no effects of parents' reports. In sum, family cohesion of both perspectives showed substantial cross-sectional associations with personality and achievement. However, there was only one longitudinal effect on achievement change by the students' perspective.

**Table 5**  
Standardized Effects of Family Cohesion on Personality and Achievement in the Cross-Lagged Personality and Achievement Models

|                          | Personality – German grade |     |      |       |     |       | Personality – math grade |     |      |       |     |      | Personality – spelling comp. |     |      |       |     |      | Personality – mathematics competence |     |      |       |     |      |
|--------------------------|----------------------------|-----|------|-------|-----|-------|--------------------------|-----|------|-------|-----|------|------------------------------|-----|------|-------|-----|------|--------------------------------------|-----|------|-------|-----|------|
|                          | P T2                       |     |      | GG T2 |     |       | P T2                     |     |      | MG T2 |     |      | P T2                         |     |      | SC T2 |     |      | P T2                                 |     |      | MC T2 |     |      |
|                          | β                          | SE  | p    | β     | SE  | p     | β                        | SE  | p    | β     | SE  | p    | β                            | SE  | p    | β     | SE  | p    | β                                    | SE  | p    | β     | SE  | p    |
| <b>Neuroticism</b>       |                            |     |      |       |     |       |                          |     |      |       |     |      |                              |     |      |       |     |      |                                      |     |      |       |     |      |
| Family cohesion students | .01                        | .03 | .687 | .07** | .02 | <.001 | .02                      | .03 | .537 | .03   | .02 | .082 | .02                          | .03 | .577 | .02   | .01 | .194 | .01                                  | .03 | .617 | -.01  | .01 | .379 |
| Family cohesion parents  | -.05                       | .03 | .032 | .02   | .01 | .288  | -.05                     | .03 | .033 | -.02  | .02 | .235 | -.05                         | .03 | .032 | .00   | .01 | .896 | -.06                                 | .03 | .027 | -.01  | .01 | .312 |
| R <sup>2</sup>           | .55**                      |     |      | .35** |     |       | .55**                    |     |      | .29** |     |      | .55**                        |     |      | .73** |     |      | .55**                                |     |      | .57** |     |      |
| <b>Extraversion</b>      |                            |     |      |       |     |       |                          |     |      |       |     |      |                              |     |      |       |     |      |                                      |     |      |       |     |      |
| Family cohesion students | .02                        | .02 | .406 | .06** | .02 | <.001 | .02                      | .02 | .348 | .04   | .02 | .014 | .02                          | .02 | .359 | .02   | .01 | .232 | .02                                  | .02 | .460 | -.00  | .01 | .734 |
| Family cohesion parents  | .02                        | .02 | .376 | .02   | .01 | .302  | .02                      | .02 | .365 | -.02  | .02 | .292 | .02                          | .02 | .386 | .00   | .01 | .770 | .02                                  | .02 | .410 | -.01  | .01 | .395 |
| R <sup>2</sup>           | .58**                      |     |      | .35** |     |       | .58**                    |     |      | .30** |     |      | .58**                        |     |      | .73** |     |      | .58**                                |     |      | .57** |     |      |
| <b>Openness</b>          |                            |     |      |       |     |       |                          |     |      |       |     |      |                              |     |      |       |     |      |                                      |     |      |       |     |      |
| Family cohesion students | -.04                       | .02 | .059 | .06** | .02 | <.001 | -.04                     | .02 | .086 | .03   | .02 | .062 | -.04                         | .02 | .096 | .01   | .01 | .522 | -.04                                 | .02 | .084 | -.01  | .01 | .260 |
| Family cohesion parents  | -.01                       | .02 | .655 | .02   | .01 | .290  | -.01                     | .02 | .673 | -.02  | .02 | .263 | -.01                         | .02 | .677 | .00   | .01 | .895 | -.01                                 | .02 | .688 | -.01  | .01 | .339 |
| R <sup>2</sup>           | .72**                      |     |      | .35** |     |       | .72**                    |     |      | .30** |     |      | .72**                        |     |      | .73** |     |      | .72**                                |     |      | .57** |     |      |
| <b>Agreeableness</b>     |                            |     |      |       |     |       |                          |     |      |       |     |      |                              |     |      |       |     |      |                                      |     |      |       |     |      |
| Family cohesion students | -.03                       | .03 | .253 | .07** | .02 | <.001 | -.03                     | .03 | .267 | .03   | .02 | .134 | -.04                         | .03 | .202 | .01   | .01 | .490 | -.04                                 | .03 | .212 | -.01  | .01 | .717 |
| Family cohesion parents  | .05                        | .03 | .075 | .02   | .01 | .254  | .05                      | .03 | .078 | -.02  | .02 | .282 | .05                          | .03 | .073 | .00   | .01 | .935 | .04                                  | .03 | .085 | -.01  | .01 | .364 |
| R <sup>2</sup>           | .51**                      |     |      | .35** |     |       | .51**                    |     |      | .30** |     |      | .51**                        |     |      | .73** |     |      | .51**                                |     |      | .57** |     |      |
| <b>Conscientiousness</b> |                            |     |      |       |     |       |                          |     |      |       |     |      |                              |     |      |       |     |      |                                      |     |      |       |     |      |
| Family cohesion students | -.02                       | .02 | .363 | .04   | .02 | .019  | -.03                     | .02 | .285 | -.01  | .02 | .470 | -.02                         | .02 | .344 | -.00  | .01 | .871 | -.02                                 | .02 | .295 | -.03  | .01 | .054 |
| Family cohesion parents  | .02                        | .03 | .273 | .02   | .01 | .257  | .02                      | .02 | .266 | -.02  | .02 | .296 | .03                          | .02 | .265 | .00   | .01 | .829 | .02                                  | .02 | .304 | -.01  | .01 | .350 |
| R <sup>2</sup>           | .62**                      |     |      | .35** |     |       | .62**                    |     |      | .30** |     |      | .62**                        |     |      | .73** |     |      | .62**                                |     |      | .57** |     |      |

Note. P = Personality, GG = German Grade, MG = Math Grade, SC = Spelling Competence, MC = Mathematics Competence, β = Standardized effect, SE = Standard error, R<sup>2</sup> = Coefficient of determination. Grades were recoded so that higher numbers indicate better performance. Effects were controlled for gender, attending an academic track school, parents' years of education, and migration background. N = 4,355.

\*\* p < .01.

## **Discussion**

Drawing on a large-scale longitudinal data set, the aim of the current study was to investigate the interrelations of the Big Five personality traits, achievement, and family cohesion in adolescence. To do so, we examined the cross-sectional and longitudinal interplay between (change in) the five personality traits and (change in) four different achievement indicators (German and math grades and competence tests) as well as the value of student and parent ratings of family cohesion in predicting interindividual differences in personality change and achievement change from Grade 7 to Grade 9. The results showed that personality, achievement, and family cohesion are interrelated in adolescence, although these interrelations may be more cross-sectional than longitudinal in nature. With respect to longitudinal associations between personality and achievement, conscientiousness was the strongest positive and extraversion was the strongest negative personality predictor of achievement. Negative personality change in conscientiousness and extraversion was predicted by students' competencies, respectively. In the following, we discuss and interpret the findings and highlight implications for future research.

### **Cross-Sectional Associations of Personality and Achievement**

The investigation of our first research goal revealed notable cross-sectional findings that both replicated previous results and added new ones: Each personality trait was related to achievement, especially conscientiousness and openness. These findings indicate that achievement measures, particularly grades, not only reflect achievement but also share a significant part of their variance with personality (Borghans et al., 2016). With the importance of grades for further education and possibly even career paths, the confounding of achievement and personality in grades should be more widely recognized. At the same time, substantial associations with achievement test scores emphasize that personality might also boost the acquisition of new (testable) competencies (Cupani & Pautassi, 2013). Most importantly, personality remained a substantial predictor of achievement over and above gender, academic track schools, migration background, and parents' years of education.

### **The Longitudinal Interplay of Personality and Achievement**

Overall, our results suggest that personality is associated with relative change in achievement, but achievement is also related to relative change in personality in adolescence.



At the same time, the few small and sometimes contradictory findings might also encourage further research and discussions of this interplay. We highlight four of the findings next.

First, supporting both our expectations and previous studies (Chamorro-Premuzic & Furnham, 2003; Spengler et al., 2016), students who concentrated and worked diligently received better grades 2 years later. Thus, already in adolescence, conscientiousness appears to be a key personality characteristic that is related to more positive life outcomes (Bogg & Roberts, 2004; Ng, Eby, Sorensen, & Feldman, 2005). Furthermore, grades rather than pure competence test scores appear to partly reflect behavioral tendencies in the school context, such as engagement and commitment. Thus, grades show associations with personality, especially with conscientiousness. Contrary to our assumptions, however, neither openness nor neuroticism showed the expected associations with change in achievement. Openness was unrelated to achievement tests altogether and had only negative effects on math grades 2 years later. One possible explanation for such findings is the focus of the openness measure in the BFI-10 on creativity and fantasy. Further research is needed to supplement these findings and examine longitudinal associations between a more intellect-oriented openness measure and academic achievement tests. Neuroticism did not play out as a vulnerability factor. Instead, being neurotic and therefore possibly nervous about making mistakes might lead to more careful and controlling behavior (Perkins & Corr, 2005), at least when it comes to spelling, or as Mohan and Kumar (1979) showed, in the context of easier tasks.

Second, extraversion, which had mixed findings in previous studies (Poropat, 2009; Wolf & Ackermann, 2005), showed a consistent but small negative effect on math grades, spelling competence, and mathematics competence. What could be possible explanations for such patterns? This negative longitudinal effect in the full model may have been driven by a third variable. One possible third variable is interest or motivation: Perhaps more social students are less interested in math (Feist, 2012) or not motivated to put much effort into school subjects they do not like. In support of this assumption, other researchers have interpreted the negative association as suggesting that introverted students spend more time studying, whereas extraverted students spend more time socializing (Chamorro-Premuzic, Furnham, & Ackerman, 2006; Eysenck, 1992).

Third, we found that academic competencies were associated with relative changes in student personality 2 years later. Specifically, we found two small unexpected negative effects: an effect of spelling competence on change in extraversion and an effect of mathematics competence on conscientiousness 2 years later. These effects were unexpected and need further discussion. The effect on extraversion might again be explained by considering interest as a

third variable. For example, being competent in spelling may be associated with interests that are usually carried out alone (e.g., writing or reading) or with more time spent studying (Chamorro-Premuzic et al., 2006; Feist, 2012) but less time spent in social contexts. This tendency could then result in even less extraversion 2 years later. With respect to the negative effect on conscientiousness, it is possible that more math competence (i.e., the ability to apply mathematical problem solving in realistic situations) could enhance the students' feeling of self-efficacy (Bandura, 1997; Valentine, Dubois, & Cooper, 2004; Levpušček, Zupančič, & Sočan, 2012). In turn, such feelings of self-efficacy based on high competence might relate to less disciplined and diligent working behaviors (i.e., less conscientiousness). However, the speculative nature of these ideas highlights the need for further research to replicate and extend these results as well as to consider more diverse third variables that might provide further explanations for some of the presented findings. As one possible route, for example, being competent or having good abilities either in spelling or in mathematical problem solving might not be the key driver for changing a student's personality in the long term, but it might be important for changing interest in a particular subject, academic self-concept, or the social feedback of others such as peers, teachers, and parents (Marsh & O'Mara, 2008; Wagner, Lüdtke, Robitzsch, Göllner, & Trautwein, 2018). Feeling competent during this challenging life phase might also prove to be a valuable resource and to enhance the developmental process when adolescents are confronted with new expectations and reference values (Denissen et al., 2013; Erikson, 1959). Another route for future research might involve considering constructs that are situated at more similar levels of specificity and, for example, the investigation of facets of conscientiousness and extraversion when simultaneously considering diverse and content-specific achievement variables (for a similar argument with respect to personality and social relationships, see Mund & Neyer, 2014; O'Connor & Paunonen, 2007).

Finally, we looked at between-domain correlated change to investigate the possibility of the co-development of personality and achievement. Our results yielded two significant correlated changes, both regarding conscientiousness. Relative change in conscientiousness was positively related to relative change in German and math grades. Thus, showing increasingly conscientious behaviors, thoughts, and feelings and an improvement in grades might be driven by similar processes in adolescence, such as being motivated, having an ambitious attitude, or looking for a supportive environment. The fact that the cross-sectional correlations between conscientiousness and grades were similar to the longitudinal correlated change results can be interpreted as evidence of stable associations between these variables over time or "intercorrelations stationarity" (Allemand & Martin, 2016, p. 238; see also

Allemand, Zimprich, & Martin, 2008). Moreover, this stable effect underlines the strong association between conscientiousness and grades rather than competence tests because grades offer a more diverse measure of not only achievement but also behavior in school and maybe the student-teacher relationship. This finding also confirms the differentiated pattern between conscientiousness and achievement indicators (grades vs. competence tests) that has also been shown in previous studies (Spengler et al., 2013). However, more time points and shorter intervals are needed to draw conclusions about the mechanisms underlying the concurrent development of conscientiousness and grades because short-term versus long-term change associations may lead to different implications (Allemand & Martin, 2016; see also Dormann & Griffin, 2015). Linking short- and long-term processes in general might help to provide a better understanding of the reciprocal effects studied here and might thus yield more answers about the effects and drivers of adolescent personality development (Wrzus & Roberts, 2016).

### **Family Cohesion as a Predictor of Personality and Achievement Change**

Furthermore, we expected family cohesion to be important for adolescents' personality and achievement outcomes 2 years later. Although family cohesion showed initial correlations with all Big Five traits and all achievement indicators, family cohesion rated by students predicted a positive change only in German grades but not in any other achievement indicator or personality trait. These results partly contradicted our expectations: We expected family cohesion ratings to be predictive of all achievement indicators 2 years later. With respect to achievement, being part of a family with good cohesion might entail regular communication and debating and might thereby promote German subject-related skills (Ho Sui-Chu & Willms, 1996). However, parent ratings of family cohesion did not show any effects on student achievement. These results are in contrast to results from previous meta-analyses (Castro et al., 2015; Hill & Tyson, 2009; Piquart, 2016). However, they are in line with previous studies that have found that adolescents and parents usually differ in how they perceive family communication or cohesion (Barnes & Olson, 1985; Paulson, 1994). The level of student-parent agreement on family cohesion in our study was fairly small ( $r = .24, p < .01$ ), and in order to affect children's outcomes, parents' behavior must be perceived by children (Piquart, 2016). The non-results of personality are in line with the results presented by Branje et al. (2004), who found that change in the perception of support rather than initial levels of family support was related to personality change in adolescence. With respect to van den Akker (2014), who found small effects of parenting on a child's personality development but also found more evidence

of an effect in the other direction, future studies should examine correlated change in shorter time intervals.

Possible explanations for the limited findings are threefold: First, given that family cohesion is only one part of a supportive family, other more achievement-related aspects, such as developing consistent communication about school (Castro et al., 2015) or achievement-oriented control (Karbach et al., 2013), could play key roles when it comes to students' achievement. Similarly, the supportive aspect of family might need to be more closely related to facets of personal development (cf. Syed & Seiffge-Krenke, 2013) in order to show associations with personality change. Second, especially for this age group with the increasing importance of peer relationships, the additional consideration of this social relationship type is an important extension for investigating the diverse (social) contexts of personality development during adolescence. Relatedly, Gauze, Bukowski, Aquan-Assee, and Sippola (1996) emphasized that a possible interplay of family and peer factors should be considered. Finally, mean levels of family cohesion were quite high. An underrepresentation of students in families with poor cohesion might also provide one explanation for the small number of effects and might also limit the generalizability of the results.

In sum, family cohesion might be supportive of a positive change in German grades, but substantial cross-sectional correlations did not translate into a decisive role of this variable in personality change in adolescence. Future research should broaden its consideration of social environments, their interrelations, and their specific dynamics for change in personality and achievement.

### **Limitations and Outlook**

Despite the current study's strengths of employing a large longitudinal data set with personality and different achievement indicators as well as student and parent reports of family cohesion in the crucial developmental period of adolescence, some methodological caveats should be mentioned as well.

First, the two-item measures of each personality trait showed relatively low internal consistencies that improved somewhat at T2. This issue might be due to the age group of interest (Roberts & DelVecchio, 2000; Spengler et al., 2013) but could also be considered a potential trade-off between large-scale panel studies and the consideration of relatively broad psychological constructs (cf. Lucas & Donnellan, 2011). Also, the slightly higher alpha values for neuroticism, extraversion, and openness at T2 do not necessarily indicate that the measures' internal consistencies improved but could also be due to the drop-out process. We assume that

the main reason for the low internal consistencies is the fact that the traits were measured with only two items (or three items for agreeableness) that covered different aspects of each broad trait.

Second, an alternative explanation for the effects that emerged is the possibility of shared rater variance: Constructs measured by the same person could also be correlated because they have the same source (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). At the same time, a student's own subjective perception might be more relevant for his or her own development. For example, high parental ratings of family cohesion might not translate into positive change in adolescents' personality and achievement if the adolescents have a different perception of family cohesion (Paulson, 1994).

Third, we agree that our effect sizes are generally small, but they are comparable to effect sizes from previous studies (Spengler et al., 2016). Personality psychology is often confronted with rather small effect sizes, and in our study, there are at least three possible reasons: First, personality was measured with a very brief scale including only two items per trait; second, the time span of 2 years between measurement points has to be considered rather long; third, despite the long retest interval, the stability of personality and achievement was quite high. Nevertheless, we know from research in (personality) psychology that even small effects can be meaningful (Neyer & Asendorpf, 2001).

Finally, our study relied on nonexperimental longitudinal data and thus did not allow for a controlled manipulation of the personality or achievement variables. Therefore, we cannot draw any causal inferences from our findings (see Morgan & Winship, 2015). Moreover, we conducted an extensive number of analyses, and replication studies are required to reinforce the patterns found in our results and in previous studies.

## **Conclusion**

In addition to the replication of cross-sectional associations between personality and achievement, our paper found initial evidence (albeit with small effects) of a longitudinal interplay between personality (change) and achievement (change). Specifically, personality might not be such an important longitudinal predictor as could be assumed from previous cross-sectional patterns. Furthermore, family cohesion did not play a pivotal role in personality change in adolescence. To fully understand the dynamics of stability and change in the Big Five during adolescence, future studies should consider and investigate a broader range and more specific facets of the developmental contexts of adolescents.

### Declaration of Conflicting Interests

The author(s) declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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### Footnotes

1. Originally, the variable school type included seven different German school types (primary schools; secondary schools; general schools – the German “Hauptschule”; integrated comprehensive schools; schools with different courses of education; special schools [for students with special educational needs]; higher track schools – the German “Gymnasium”). Although the original school variable was more differentiated (seven school types from the German educational systems), the dummy coding was based on previous findings illustrating that the strongest differences in achievement-related variables occurred between the German Gymnasium and the other school types (Maaz et al., 2008). Moreover, given that about half of the students attended this type of school, it also offered a good way to divide the sample.
2. We included a detailed explanation and description of the reliability estimation in the Online Supplement part B.
3. Referring to the covariates, we discovered significant effects of gender, attending an academic track school, and parents’ years of education: Female adolescents had better grades in German and higher spelling competence test scores but less mathematics competence than male adolescents. Students who attended a higher track school and had parents with more years of education showed better achievement overall.
4. First, gender was a substantial predictor in most of the models showing the following differences: Female adolescents were more neurotic, less extraverted, and had better and higher competencies than male adolescents 2 years later. Second, when school type was included, students in academic track schools had better grades in German and higher competencies at T2. Surprisingly, college-bound students also reported lower conscientiousness 2 years later. Third, students with migration background did not differ from students without migration background in their reports of personality and achievement changes 2 years later. Finally, parents’ education levels did not predict changes in personality but did show positive effects on changes in grades and mathematics competence.

## Appendix Study 2

## A: Supplement Tables

Table OS1

*Descriptive Statistics, Effect Sizes and Stabilities for Personality, Achievement, Family Cohesion, and Covariates*

|                        |                                 | T1 (grade 7, $\bar{O}$ = 12.9 years) |          |          | T2 (grade 9, $\bar{O}$ = 14.9 years) |          |          | Effect size | Stability |
|------------------------|---------------------------------|--------------------------------------|----------|----------|--------------------------------------|----------|----------|-------------|-----------|
|                        |                                 | <i>M</i> ( <i>SD</i> )               | <i>n</i> | $\alpha$ | <i>M</i> ( <i>SD</i> )               | <i>n</i> | $\alpha$ | <i>d</i>    | <i>r</i>  |
| <b>Personality</b>     | Neuroticism                     | 2.82 (0.83)                          | 4194     | .34      | 2.84 (0.87)                          | 3611     | .46      | 0.02        | .37**     |
|                        | Extraversion                    | 3.41 (0.79)                          | 4186     | .43      | 3.32 (0.87)                          | 3612     | .63      | -0.11**     | .49**     |
|                        | Openness                        | 3.47 (0.96)                          | 4195     | .38      | 3.38 (0.96)                          | 3610     | .47      | -0.09**     | .54**     |
|                        | Agreeableness                   | 3.46 (0.65)                          | 4193     | .39      | 3.44 (0.65)                          | 3612     | .40      | -0.03**     | .38**     |
|                        | Conscientiousness               | 3.22 (0.85)                          | 4195     | .53      | 3.04 (0.84)                          | 3612     | .52      | -0.23**     | .52**     |
| <b>Achievement</b>     | German grade                    | 4.40 (0.84)                          | 3916     |          | 4.33 (0.82)                          | 3541     |          | -0.08**     | .55**     |
|                        | Math grade                      | 4.33 (0.95)                          | 3904     |          | 4.16 (1.00)                          | 3538     |          | -0.17**     | .52**     |
|                        | Spelling comp. (WLE)            | 0.13 (1.35)                          | 4215     |          | 0.11 (1.46)                          | 3387     |          | -0.03**     | .84**     |
|                        | Mathematics comp. (WLE)         | 0.86 (1.22)                          | 4217     |          | 0.13 (1.19)                          | 3390     |          | -0.61**     | .73**     |
| <b>Family cohesion</b> | Student ratings                 | 3.72 (0.75)                          | 4062     | .76      |                                      |          |          |             |           |
|                        | Parent ratings                  | 4.41 (0.53)                          | 3873     | .65      |                                      |          |          |             |           |
| <b>Covariates</b>      | Gender (1 = female)             | 0.49 (0.50)                          | 4191     |          |                                      |          |          |             |           |
|                        | Academic track school (1 = yes) | 0.52 (0.50)                          | 4355     |          |                                      |          |          |             |           |
|                        | migration background (1 = yes)  | 0.04 (0.19)                          | 4114     |          |                                      |          |          |             |           |
|                        | years of parents' education     | 14.14 (2.31)                         | 3827     |          |                                      |          |          |             |           |

*Note.* Grades were recoded so that higher numbers indicate better performance.  $\alpha$  = Cronbach's alpha. *d* = Cohen's *d*. WLE = Weighted Likelihood Estimate.

\*\*  $p < .01$ .

**Table OS2***Correlation Matrix of All Variables of Personality and Achievement at T2 and Family Cohesion and Covariates at T1*

|                                    | 1      | 2      | 3     | 4      | 5      | 6      | 7     | 8      | 9      | 10    | 11    | 12   | 13    | 14     |
|------------------------------------|--------|--------|-------|--------|--------|--------|-------|--------|--------|-------|-------|------|-------|--------|
| 1. Neuroticism T2                  |        |        |       |        |        |        |       |        |        |       |       |      |       |        |
| 2. Extraversion T2                 | -.28** |        |       |        |        |        |       |        |        |       |       |      |       |        |
| 3. Openness T2                     | .02    | .05    |       |        |        |        |       |        |        |       |       |      |       |        |
| 4. Agreeableness T2                | -.01   | .00    | .12** |        |        |        |       |        |        |       |       |      |       |        |
| 5. Conscientiousness T2            | .02    | .07**  | .07** | .18**  |        |        |       |        |        |       |       |      |       |        |
| 6. German grade T2                 | .03    | .06**  | .14** | .04    | .21**  |        |       |        |        |       |       |      |       |        |
| 7. Math grade T2                   | -.03   | -.05** | -.01  | .00    | .17**  | .42**  |       |        |        |       |       |      |       |        |
| 8. Spelling competence T2          | .04    | .00    | .10** | .05**  | .05**  | .44**  | .21** |        |        |       |       |      |       |        |
| 9. Mathematics competence T2       | -.08** | -.05** | .03   | -.06** | -.06** | .27**  | .40** | .50**  |        |       |       |      |       |        |
| 10. Family cohesion students T1    | -.06** | .14**  | .07** | .16**  | .20**  | .18**  | .09** | .15**  | .04    |       |       |      |       |        |
| 11. Family cohesion parents T1     | -.06** | .06**  | .01   | .08**  | .05**  | .07**  | .02   | .05    | .01    | .24** |       |      |       |        |
| 12. Gender T1                      | .27**  | -.01   | .21** | .14**  | .17**  | .25**  | .00   | .23**  | -.13** | .04   | .00   |      |       |        |
| 13. Academic track school T1       | -.02   | .05**  | .05** | -.03   | -.06** | .22**  | .11** | .54**  | .50**  | .11** | .07** | .04  |       |        |
| 14. Migration background T1        | -.02   | .00    | .00   | -.04   | -.02   | -.06** | -.02  | -.06** | -.04   | -.03  | -.03  | -.04 | -.03  |        |
| 15. Parents' years of education T1 | -.04   | .02    | .06** | -.01   | -.03   | .20**  | .18** | .26**  | .32**  | .07** | .07** | .02  | .34** | -.05** |

*Note.* Grades were recoded so that higher numbers indicate better performance. The variables gender (1 = female), academic track school (1 = yes), and migration background (1 = yes) were dummy-coded.  $N = 4,355$ .

\*\*  $p < .01$ .



**Table OS3***Unstandardized Effects of Hierarchical Multiple Regressions With All Achievement Indicators Predicted by Personality and Covariates at T1*

|                                  | Achievement T1 |           |          |            |           |          |                     |           |          |                        |           |          |
|----------------------------------|----------------|-----------|----------|------------|-----------|----------|---------------------|-----------|----------|------------------------|-----------|----------|
|                                  | German grade   |           |          | Math grade |           |          | Spelling competence |           |          | Mathematics competence |           |          |
|                                  | <i>b</i>       | <i>SE</i> | <i>p</i> | <i>b</i>   | <i>SE</i> | <i>p</i> | <i>b</i>            | <i>SE</i> | <i>p</i> | <i>b</i>               | <i>SE</i> | <i>p</i> |
| <b>Predictors of Model Set 1</b> |                |           |          |            |           |          |                     |           |          |                        |           |          |
| Neuroticism                      | 0.00           | 0.02      | .802     | -0.09**    | 0.02      | <.001    | -0.01               | 0.03      | .708     | -0.16**                | 0.02      | <.001    |
| Extraversion                     | 0.08**         | 0.02      | <.001    | -0.02      | 0.02      | .283     | 0.13**              | 0.03      | <.001    | -0.03                  | 0.02      | .214     |
| Openness                         | 0.08**         | 0.01      | <.001    | -0.01      | 0.02      | .477     | 0.12**              | 0.02      | <.001    | 0.11**                 | 0.02      | <.001    |
| Agreeableness                    | 0.01           | 0.02      | .570     | -0.01      | 0.03      | .639     | -0.00               | 0.03      | .942     | -0.09**                | 0.03      | .006     |
| Conscientiousness                | 0.21**         | 0.02      | <.001    | 0.17**     | 0.02      | <.001    | 0.19**              | 0.03      | <.001    | -0.02                  | 0.02      | .504     |
| <i>R</i> <sup>2</sup>            | .07**          |           |          | .03**      |           |          | .03**               |           |          | .02**                  |           |          |
| <b>Predictors of Model Set 2</b> |                |           |          |            |           |          |                     |           |          |                        |           |          |
| Neuroticism                      | -0.01          | 0.02      | .731     | -0.03      | 0.02      | .085     | -0.00               | 0.02      | .941     | -0.07**                | 0.02      | .001     |
| Extraversion                     | 0.06**         | 0.02      | <.001    | -0.02      | 0.02      | .439     | 0.06                | 0.02      | .018     | -0.07**                | 0.02      | <.001    |
| Openness                         | 0.03           | 0.01      | .029     | -0.02      | 0.02      | .274     | 0.01                | 0.02      | .662     | 0.08**                 | 0.02      | <.001    |
| Agreeableness                    | -0.01          | 0.02      | .634     | -0.03      | 0.03      | .318     | -0.00               | 0.03      | .965     | -0.03                  | 0.03      | .377     |
| Conscientiousness                | 0.19**         | 0.02      | <.001    | 0.19**     | 0.02      | <.001    | 0.11                | 0.02      | <.001    | -0.01                  | 0.02      | .621     |
| <b>Covariates</b>                |                |           |          |            |           |          |                     |           |          |                        |           |          |
| Gender                           | 0.22**         | 0.03      | <.001    | -0.19**    | 0.03      | <.001    | 0.43**              | 0.04      | <.001    | -0.43**                | 0.04      | <.001    |
| Academic track school            | 0.25**         | 0.03      | <.001    | 0.24**     | 0.03      | <.001    | 1.25**              | 0.04      | <.001    | 0.98**                 | 0.04      | <.001    |
| Migration background             | -0.12          | 0.08      | .134     | -0.13      | 0.09      | .166     | -0.34**             | 0.10      | .001     | -0.25                  | 0.10      | .011     |
| Parents' years of education      | 0.06**         | 0.01      | <.001    | 0.06**     | 0.01      | <.001    | 0.05**              | 0.01      | <.001    | 0.08**                 | 0.01      | <.001    |
| <i>R</i> <sup>2</sup>            | .16**          |           |          | .09**      |           |          | .32**               |           |          | .28**                  |           |          |

*Note.* *b* = unstandardized coefficient; *SE* = Standard error; *R*<sup>2</sup> = Coefficient of determination. Grades are recoded so that higher numbers indicate better performance. The variables gender (1 = female), academic track school (1 = yes), and migration background (1 = yes) were dummy-coded.

\*\* *p* < .01

**Table OS4***Standardized Stability Effects, Cross-Lagged Effects, and Correlations for the Cross-lagged Personality and Achievement Models Without Covariates*

|                          | Stability |         | Cross-lagged effects |      |      |         |      |      | Correlations    |                 |
|--------------------------|-----------|---------|----------------------|------|------|---------|------|------|-----------------|-----------------|
|                          | P1 → P2   | A1 → A2 | P1 → A2              |      |      | A1 → P2 |      |      | $\rho_{P_1A_1}$ | $\rho_{P_2A_2}$ |
|                          |           |         | $\beta$              | SE   | p    | $\beta$ | SE   | p    |                 |                 |
| <b>Neuroticism</b>       |           |         |                      |      |      |         |      |      |                 |                 |
| German grade             | .71**     | .56**   | .04                  | 0.02 | .065 | .06**   | 0.02 | .006 | -.04            | -.01            |
| Maths grade              | .71**     | .54**   | .04                  | 0.02 | .036 | -.04    | 0.02 | .107 | -.11**          | -.02            |
| Spelling competence      | .71**     | .85**   | .05**                | 0.01 | .000 | .04     | 0.02 | .048 | -.04            | .02             |
| Mathematics competence   | .70**     | .74**   | .01                  | 0.02 | .619 | -.06    | 0.02 | .011 | -.14**          | -.02            |
| <b>Extraversion</b>      |           |         |                      |      |      |         |      |      |                 |                 |
| German grade             | .76**     | .56**   | .04                  | 0.02 | .027 | -.03    | 0.02 | .089 | .11**           | .02             |
| Math grade               | .76**     | .53**   | -.08**               | 0.02 | .000 | -.04    | 0.02 | .065 | -.00            | .04             |
| Spelling competence      | .77**     | .85**   | -.03                 | 0.01 | .036 | -.06**  | 0.02 | .003 | .11**           | -.00            |
| Mathematics competence   | .76**     | .73**   | -.04                 | 0.02 | .013 | -.03    | 0.02 | .219 | .01             | -.04            |
| <b>Openness</b>          |           |         |                      |      |      |         |      |      |                 |                 |
| German grade             | .85**     | .55**   | .08**                | 0.02 | .000 | .02     | 0.02 | .472 | .16**           | .05             |
| Math grade               | .85**     | .53**   | -.03                 | 0.02 | .191 | -.02    | 0.02 | .284 | .00             | .04             |
| Spelling competence      | .85**     | .84**   | .04**                | 0.01 | .001 | -.03    | 0.02 | .167 | .14**           | .05             |
| Mathematics comp. test   | .85**     | .73**   | -.01                 | 0.02 | .778 | -.01    | 0.02 | .471 | .10**           | -.03            |
| <b>Agreeableness</b>     |           |         |                      |      |      |         |      |      |                 |                 |
| German grade             | .71**     | .56**   | .04                  | 0.02 | .099 | -.02    | 0.03 | .483 | .12**           | -.02            |
| Math grade               | .71**     | .53**   | .01                  | 0.02 | .800 | -.05    | 0.03 | .068 | .05             | .00             |
| Spelling competence      | .71**     | .84**   | .03                  | 0.02 | .089 | -.01    | 0.02 | .750 | .07**           | .05             |
| Mathematics competence   | .71**     | .73**   | -.03                 | 0.02 | .040 | -.05    | 0.02 | .034 | -.04            | .02             |
| <b>Conscientiousness</b> |           |         |                      |      |      |         |      |      |                 |                 |
| German grade             | .79**     | .53**   | .12**                | 0.02 | .000 | -.05    | 0.02 | .023 | .27**           | .15**           |
| Math grade               | .78**     | .51**   | .11**                | 0.02 | .000 | -.05    | 0.02 | .018 | .19**           | .14**           |
| Spelling competence      | .79**     | .84**   | .05**                | 0.01 | .000 | -.10**  | 0.02 | .000 | .16**           | .02             |
| Mathematics competence   | .77**     | .74**   | .03                  | 0.02 | .034 | -.13**  | 0.02 | .000 | -.02            | .03             |

Note.  $\beta$  = standardized effects; SE = Standard error; P = Personality, A = Achievement, Pi = Personality score at Ti, Ai = Achievement score at Ti. N = 4348-4355.

\*\* p < .01

**Table OS5***Stability Effects, Unstandardized Cross-Lagged Effects, and Correlations for the Cross-Lagged Personality and Achievement Models*

|                          | Stability |         | Cross-lagged effects |           |          |          |           |          | Correlations |       |
|--------------------------|-----------|---------|----------------------|-----------|----------|----------|-----------|----------|--------------|-------|
|                          | P1 → P2   | A1 → A2 | P1 → A2              |           |          | A1 → P2  |           |          | ρP1A1        | ρP2A2 |
|                          |           |         | <i>b</i>             | <i>SE</i> | <i>p</i> | <i>b</i> | <i>SE</i> | <i>p</i> |              |       |
| <b>Neuroticism</b>       |           |         |                      |           |          |          |           |          |              |       |
| German grade             | .71**     | .50**   | 0.02                 | 0.03      | .562     | 0.01     | 0.02      | .445     | -.04         | -.06  |
| Math grade               | .71**     | .56**   | 0.06                 | 0.04      | .105     | -0.02    | 0.02      | .323     | -.11**       | -.04  |
| Spelling competence      | .71**     | .83**   | 0.11**               | 0.03      | .002     | -0.00    | 0.01      | .799     | -.04         | -.03  |
| Mathematics competence   | .71**     | .61**   | 0.05                 | 0.03      | .110     | -0.03    | 0.01      | .060     | -.13**       | -.03  |
| <b>Extraversion</b>      |           |         |                      |           |          |          |           |          |              |       |
| German grade             | .87**     | .50**   | 0.04                 | 0.02      | .091     | -0.02    | 0.02      | .289     | .11**        | .03   |
| Math grade               | .87**     | .55**   | -0.14**              | 0.03      | <.001    | -0.03    | 0.02      | .044     | -.00         | .05   |
| Spelling competence      | .88**     | .83**   | -0.08**              | 0.03      | .008     | -0.03**  | 0.01      | .005     | .11**        | -.00  |
| Mathematics competence   | .87**     | .60**   | -0.11**              | 0.03      | <.001    | -0.02    | 0.02      | .101     | .01          | -.05  |
| <b>Openness</b>          |           |         |                      |           |          |          |           |          |              |       |
| German grade             | .83**     | .49**   | 0.04                 | 0.02      | .060     | 0.02     | 0.02      | .402     | .16**        | .05   |
| Math grade               | .83**     | .55**   | -0.07**              | 0.03      | .009     | -0.01    | 0.02      | .409     | .01          | .04   |
| Spelling competence      | .83**     | .83**   | 0.02                 | 0.02      | .367     | -0.02    | 0.01      | .220     | .14**        | .05   |
| Mathematics competence   | .83**     | .61**   | -0.01                | 0.03      | .629     | -0.00    | 0.02      | .875     | .10**        | -.02  |
| <b>Agreeableness</b>     |           |         |                      |           |          |          |           |          |              |       |
| German grade             | .73**     | .50**   | 0.01                 | 0.04      | .770     | -0.01    | 0.02      | .584     | .12**        | -.02  |
| Math grade               | .73**     | .55**   | -0.02                | 0.05      | .723     | -0.02    | 0.01      | .112     | .05          | .00   |
| Spelling competence      | .72**     | .83**   | 0.03                 | 0.05      | .582     | 0.00     | 0.01      | .713     | .07**        | .07   |
| Mathematics competence   | .73**     | .61**   | -0.08                | 0.04      | .071     | -0.02    | 0.01      | .078     | -.04         | .02   |
| <b>Conscientiousness</b> |           |         |                      |           |          |          |           |          |              |       |
| German grade             | .77**     | .47**   | 0.12**               | 0.02      | <.001    | -0.02    | 0.02      | .335     | .27**        | .16** |
| Math grade               | .76**     | .53**   | 0.16**               | 0.03      | <.001    | -0.01    | 0.02      | .535     | .19**        | .14** |
| Spelling competence      | .76**     | .83**   | 0.07                 | 0.03      | .013     | -0.03    | 0.01      | .022     | .16**        | .04   |
| Mathematics competence   | .76**     | .61**   | 0.04                 | 0.03      | .136     | -0.04**  | 0.01      | .001     | -.02         | .07   |

*Note.* P = Personality, A = Achievement, *b* = Unstandardized effects, *SE* = Standard error. Grades are recoded so that higher numbers indicate better performance. Effects are controlled for gender, attending an academic track school, migration background, and parents' years of education. *N* = 4,355.

\*\* *p* < .01.

Table OS6

Unstandardized Effects of Family Cohesion on Personality and Achievement in the Cross-Lagged Personality and Achievement Models

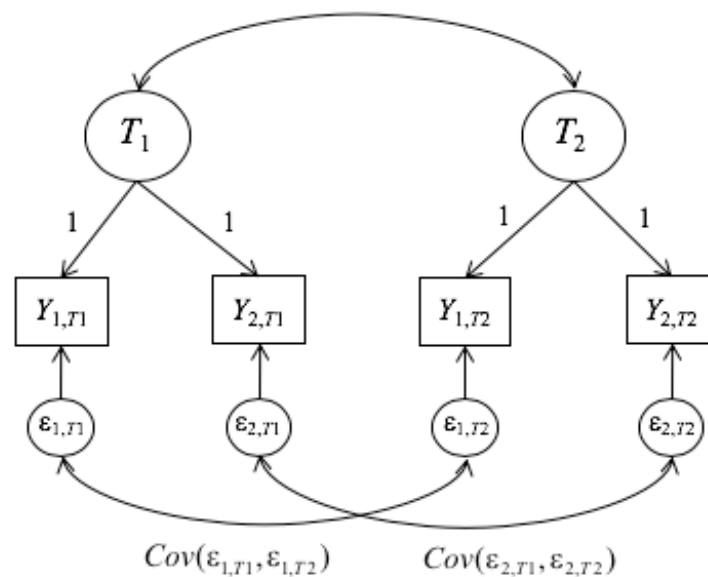
|                          | Personality – german grade |      |          |          |      |          | Personality – math grade |      |          |          |      |          | Personality – spelling comp. |      |          |          |      |          | Personality – mathematics competence |      |          |          |      |          |
|--------------------------|----------------------------|------|----------|----------|------|----------|--------------------------|------|----------|----------|------|----------|------------------------------|------|----------|----------|------|----------|--------------------------------------|------|----------|----------|------|----------|
|                          | P T2                       |      |          | GG T2    |      |          | P T2                     |      |          | MG T2    |      |          | P T2                         |      |          | SC T2    |      |          | P T2                                 |      |          | MC T2    |      |          |
|                          | <i>b</i>                   | SE   | <i>p</i> | <i>b</i> | SE   | <i>p</i> | <i>b</i>                 | SE   | <i>p</i> | <i>b</i> | SE   | <i>p</i> | <i>b</i>                     | SE   | <i>p</i> | <i>b</i> | SE   | <i>p</i> | <i>b</i>                             | SE   | <i>p</i> | <i>b</i> | SE   | <i>p</i> |
| <b>Neuroticism</b>       |                            |      |          |          |      |          |                          |      |          |          |      |          |                              |      |          |          |      |          |                                      |      |          |          |      |          |
| Family cohesion students | .01                        | 0.02 | .687     | .08**    | 0.02 | <.001    | .01                      | 0.02 | .537     | .04      | 0.02 | .081     | .01                          | 0.02 | .577     | .03      | 0.02 | .196     | .01                                  | 0.02 | .617     | -.02     | 0.02 | .379     |
| Family cohesion parents  | -.07                       | 0.03 | .032     | .02      | 0.02 | .288     | -.06                     | 0.03 | .033     | -.04     | 0.03 | .236     | -.07                         | 0.03 | .032     | .00      | 0.03 | .896     | -.07                                 | 0.03 | .027     | -.03     | 0.03 | .312     |
| <i>R</i> <sup>2</sup>    | .55**                      |      |          | .35**    |      |          | .55**                    |      |          | .29**    |      |          | .55**                        |      |          | .73**    |      |          | .55**                                |      |          | .57**    |      |          |
| <b>Extraversion</b>      |                            |      |          |          |      |          |                          |      |          |          |      |          |                              |      |          |          |      |          |                                      |      |          |          |      |          |
| Family cohesion students | .02                        | 0.02 | .406     | .07**    | 0.02 | <.001    | .02                      | 0.02 | .349     | .06      | 0.02 | .013     | .02                          | 0.02 | .360     | .03      | 0.02 | .234     | .02                                  | 0.02 | .460     | -.01     | 0.02 | .734     |
| Family cohesion parents  | .03                        | 0.03 | .376     | .02      | 0.02 | .302     | .03                      | 0.03 | .365     | -.03     | 0.03 | .293     | .03                          | 0.03 | .387     | .01      | 0.03 | .770     | .02                                  | 0.03 | .410     | -.03     | 0.03 | .395     |
| <i>R</i> <sup>2</sup>    | .58**                      |      |          | .35**    |      |          | .58**                    |      |          | .30**    |      |          | .58**                        |      |          | .73**    |      |          | .58**                                |      |          | .57**    |      |          |
| <b>Openness</b>          |                            |      |          |          |      |          |                          |      |          |          |      |          |                              |      |          |          |      |          |                                      |      |          |          |      |          |
| Family cohesion students | -.04                       | 0.02 | .059     | .07**    | 0.02 | <.001    | -.04                     | 0.02 | .085     | .04      | 0.02 | .062     | -.04                         | 0.02 | .095     | .01      | 0.02 | .522     | -.04                                 | 0.02 | .083     | -.02     | 0.02 | .261     |
| Family cohesion parents  | -.01                       | 0.03 | .655     | .02      | 0.02 | .291     | -.01                     | 0.03 | .673     | -.03     | 0.03 | .264     | -.01                         | 0.03 | .677     | .00      | 0.03 | .895     | -.01                                 | 0.03 | .688     | -.03     | 0.03 | .338     |
| <i>R</i> <sup>2</sup>    | .72**                      |      |          | .35**    |      |          | .72**                    |      |          | .30**    |      |          | .72**                        |      |          | .73**    |      |          | .72**                                |      |          | .57**    |      |          |
| <b>Agreeableness</b>     |                            |      |          |          |      |          |                          |      |          |          |      |          |                              |      |          |          |      |          |                                      |      |          |          |      |          |
| Family cohesion students | -.02                       | 0.02 | .254     | .08**    | 0.02 | <.001    | -.02                     | 0.02 | .269     | .04      | 0.03 | .134     | -.02                         | 0.02 | .204     | .02      | 0.03 | .491     | -.02                                 | 0.02 | .213     | -.01     | 0.02 | .717     |
| Family cohesion parents  | .04                        | 0.02 | .076     | .03      | 0.02 | .255     | .04                      | 0.02 | .078     | -.03     | 0.03 | .383     | .04                          | 0.02 | .074     | .00      | 0.03 | .935     | .04                                  | 0.02 | .086     | -.03     | 0.03 | .364     |
| <i>R</i> <sup>2</sup>    | .51**                      |      |          | .35**    |      |          | .51**                    |      |          | .30**    |      |          | .51**                        |      |          | .73**    |      |          | .51**                                |      |          | .57**    |      |          |
| <b>Conscientiousness</b> |                            |      |          |          |      |          |                          |      |          |          |      |          |                              |      |          |          |      |          |                                      |      |          |          |      |          |
| Family cohesion students | -.02                       | 0.02 | .363     | .04      | 0.02 | .020     | -.02                     | 0.02 | .284     | -.02     | 0.03 | .470     | -.02                         | 0.02 | .344     | -.00     | 0.03 | .871     | -.02                                 | 0.02 | .295     | -.04     | 0.02 | .055     |
| Family cohesion parents  | .03                        | 0.03 | .273     | .03      | 0.02 | .258     | .03                      | 0.03 | .266     | -.03     | 0.03 | .296     | .03                          | 0.03 | .265     | .01      | 0.03 | .829     | .03                                  | 0.03 | .304     | -.03     | 0.03 | .350     |
| <i>R</i> <sup>2</sup>    | .62**                      |      |          | .35**    |      |          | .62**                    |      |          | .30**    |      |          | .62**                        |      |          | .73**    |      |          | .62**                                |      |          | .57**    |      |          |

Note. *P* = Personality, GG = German Grade, MG = Math Grade, SC = Spelling Competence, MC = Mathematics Competence, *b* = Unstandardized Effects, SE = Standard Error, *p* = exact significance value, *R*<sup>2</sup> = Coefficient of determination. Grades are recoded so that higher numbers indicate better performance. Effects are controlled for gender, attending an academic track school, parents' years of education, and migration background. *N* = 4,355.

\*\* *p* < .01.

## B: Detailed Explanation and Description of the Statistical Approach

Controlling for unreliability can be crucial for the estimation of effects in longitudinal models, particularly when it comes to estimating the stability of variables. At the same time, the use of very short Big Five measures in panel studies such as the one at hand complicates the application of traditional latent variable modeling approaches because they are based on an internal consistency logic of measurement error. This implies that item-specific variances are treated as (random) measurement error. For example, if we apply Cronbach's alpha to correct for measurement error, we obtain (stability) correlations that are larger than 1.0. However, many methodologists and also personality researchers (see McCrae et al., 2011) have stated that item-specific variances should not be treated as measurement error. For example, among other things, McCrae et al. (2011) investigated the extent to which Cronbach's alpha is associated with different forms of reliability and concluded that the internal consistency of scales should not be used to estimate latent variables. This finding could be particularly relevant for very brief personality scales because with only a few items (or in fact two items), item-specific contributions to the total score do not average out when the responses to the individual items are aggregated into a total score. To obtain a more appropriate measure of the error variance for brief personality scales, we adopted an approach that was proposed by Green (2003). More specifically, for each personality construct, we specified a longitudinal factor model with the two items as indicators:



Furthermore, we assumed that the factors loadings were 1.0 and that the residual variances were equal across time. Then, the error variance for each scale score (i.e., obtained by averaging the two items) is given by:

$$\frac{[Var(\varepsilon_{1,T1}) + Var(\varepsilon_{2,T1})]/2}{2} - \frac{[Cov(\varepsilon_{1,T1}, \varepsilon_{1,T2}) + Cov(\varepsilon_{2,T1}, \varepsilon_{2,T2})]/2}{2}$$

where  $Var(\varepsilon_{1,T1})$  and  $Var(\varepsilon_{2,T1})$  denote the measurement error variance for Items 1 and 2, and  $Cov(\varepsilon_{1,T1}, \varepsilon_{1,T2})$  and  $Cov(\varepsilon_{2,T1}, \varepsilon_{2,T2})$  denote estimates of the respective item-specific variances. The first division (by 2) results in the average error variance, and the second takes into account the fact that the mean score of a scale is obtained by averaging the two items. Note that the residual variances  $Var(\varepsilon_{1,T1})$  and  $Var(\varepsilon_{2,T1})$  confound random measurement error variance and item-specific variance. Thus, when subtracting the average item-specific variance (second term) from the measurement error variance (first term), we obtain a purified estimate of the error variance of the scale mean in which item-specific variances are treated as true score variance.

Using this approach (in which item-specific variances are not treated as error variance), we obtained the following estimates of error variance.

*The Estimated Error Variances, Internal Consistencies, and Reliabilities of the Big Five*

| Trait             | Personality models for the estimation of the error variances |          |          |           |      |       |      | Cronbach's $\alpha$ | Reliability |
|-------------------|--|----------|----------|-----------|------|-------|------|---------------------|-------------|
|                   | Estimate   | <i>N</i> | $\chi^2$ | <i>df</i> | CFI  | RMSEA | SRMR | T1 / T2             | T1 / T2     |
| Neuroticism       | 0.344  | 4345     | 14.272   | 3         | .987 | .029  | .024 | .34 / .46           | .50 / .54   |
| Extraversion      | 0.240  | 4341     | 94.918   | 3         | .945 | .084  | .085 | .43 / .63           | .61 / .67   |
| Openness          | 0.342  | 4344     | 43.917   | 3         | .976 | .056  | .045 | .38 / .47           | .63 / .62   |
| Agreeableness     | 0.325  | 4343     | 91.388   | 12        | .940 | .039  | .060 | .39 / .40           | .53 / .54   |
| Conscientiousness | 0.195  | 4344     | 2.583    | 3         | 1    | 0     | .011 | .53 / .52           | .67 / .66   |

*Note.* *df* = degrees of freedom; CFI = comparative fit index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual. We included a detailed explanation and description of the error variances and reliability estimation in the Online Supplement part B.

In a next step, we used the resulting estimator to fix the error variance as part of the single-indicator approach for controlling for unreliability in path models (Westfall & Yarkoni, 2016). For example, in the model for neuroticism, we set the error variance to 0.344. That approach (in combination with a decrease in the significance level to  $p < .01$ ) led to the omission of some effects (especially with regard to family cohesion) but confirmed most of our previous results.







# *Chapter 4*

## **Study 3**

The Longitudinal Interplay of Personality and School Experiences in Adolescence

Israel, A., Spengler, M., Göllner, R., Brandt, N. D., Lüdtke, O., Trautwein, U., & Wagner, J. (2021). *The longitudinal interplay of personality and school experiences in adolescence*. Manuscript submitted for publication.



### **Abstract**

The school environment is one key developmental context that is assumed to shape individual characteristics during adolescence. Besides cross-sectional associations, initial evidence has suggested that personality development and changes in school experiences can also be associated over time. However, little is known about which school experiences are central to personality change or about the extent to which school experiences and personality co-shape each other over time. We address this gap by examining the longitudinal interplay between seven school experiences in the three domains of achievement, social relationships, and well-being, and the Big Five personality traits at four measurement points from fifth to eighth grade. By using data from the TRAIN study ( $N = 3,473$ ,  $M_{\text{ageT1}} = 11.1$  years, 45% female), we estimated bivariate latent growth curve models and cross-lagged panel models to illustrate this longitudinal interplay. Results demonstrated correlated change between school experiences and personality with a differentiated pattern for achievement variables and a general longitudinal interplay with the social relationship and well-being variables. Furthermore, we found cross-lagged effects in both directions, although there were more effects of personality on school experiences. The most consistent predictor of school experiences was conscientiousness, which was related to better achievement, more positive social relationships, and higher well-being in school, whereas well-being in school in particular was related to subsequently lower neuroticism and higher extraversion, agreeableness, and conscientiousness 1 year later. We integrate our findings into the current picture of personality development in adolescence and the role of school-related environmental factors.

*Keywords:* personality development, adolescence, school experiences, longitudinal interplay, developmental tasks



### **The Longitudinal Interplay of School Experiences and Personality in Adolescence**

Although adolescence is a relatively short phase in life, it has been shown to be formative with respect to diverse characteristics such as changes in physical features (Petersen et al., 1988), societal expectations (Arnett, 2000; Denissen et al., 2013; Hogan & Roberts, 2004), and psychosocial variables such as goal commitments (Crone & Dahl, 2012), identity formation (Erikson, 1959), and personality development (Caspi et al., 2005; Hill & Edmonds, 2017). Thus, adolescence is a time of normative change in many ways. Specifically, personality, defined as relatively enduring patterns of human thinking, feeling, and behaving (Roberts & Mroczek, 2008), shows lower levels of rank-order stability in this age period than in any later life phases (Roberts & DelVecchio, 2000). Given the instability and diversity in developmental trajectories of personality, it appears especially important better to understand potential predictors and possible interrelations with other important life experiences in adolescence (De Fruyt et al., 2017). As school is explicitly aimed at shaping students' individual behaviors and has plenty of room to do so as adolescents spend a great deal of their time in school (Rutter, 1979), this might be a promising context to investigate. School is a place where adolescents are confronted with new experiences, developmental tasks, and societal expectations such as to perform well on an academic level or to find their position in a community (Eccles & Roeser, 2011). These tasks in school can be mapped onto three domains that most developmental theories agree on (Erikson, 1959; Havighurst, 1956; Hogan & Roberts, 2004; Hutteman et al., 2014): achieving an academic qualification and developing competence (Erikson, 1959; Hurrelmann & Quenzel, 2018), establishing social relationships to feel integrated (Coleman, 1974; Havighurst, 1956; Hurrelmann & Quenzel, 2018), and developing social-emotional skills to cope with requirements and to feel accepted (Eccles & Roeser, 2011; Havighurst, 1956; Weissberg et al., 2015). Although research from the last decade has provided empirical evidence for the crucial role of personality in school-related outcomes such as academic achievement (Israel et al., 2019; Poropat, 2009), social belonging (e.g., Harris & Vazire, 2016; Reitz et al., 2014), and well-being (e.g., Butkovic et al., 2012; Evans et al., 2018), most of these studies have been cross-sectional and have thus been limited in their information about the development and potential longitudinal interplay of personality and school experiences in adolescence. To address this gap, we used longitudinal data to investigate the following research question: How are personality and school experiences that

are mapped onto the three major domains of achievement, social relationships, and well-being interrelated in adolescence over time?

To do so, we used four measurement points from longitudinal data that came from the large-scale Tradition and Innovation in Educational Systems (TRAIN; Jonkmann et al., 2013) study, including 3,473 German adolescent students ( $M_{\text{ageT1}} = 10.2$  years, 45% female). With up to 3-year longitudinal data, we tested the longitudinal interplay between the Big Five personality traits and different school experiences from the three domains of achievement, social relationships, and well-being in school. We applied latent growth curve models to investigate the correlated change between personality and school experiences and cross-lagged panel models to test for reciprocal associations between them over time. Our study moves beyond previous studies in four important ways: First, we investigated our research questions in a large heterogeneous sample of students from nonacademic track schools in Germany. Second, we used a diverse set of school experiences to broaden the narrow view on academic achievement to include a more complete picture of school and personality development. Third, we analyzed multiwave longitudinal data on personality and school experiences, which allowed us to both investigate correlated change and conduct a time-sensitive analysis of the reciprocal longitudinal dynamics between variables. Fourth, our longitudinal sample covered the age span of early to middle adolescence from age 10 to 14. This can be considered an optimal age span from which better to understand the possible antecedents and outcomes of personality instability and change as well as changing school experiences during the turbulent time of adolescence.

### **Personality Development in Adolescence**

Personality development can be traced back to different sources (for an overview, see Wagner et al., in press) that can be mapped onto genetic and environmental influences as well as the interaction of the two. These perspectives help to explain why personality traits are characterized by both stability and change throughout the life span (Bleidorn et al., 2020). In particular, in adolescence, major biological changes and environmental influences co-occur, making this phase especially interesting for personality development. Two distinct characteristics of change are particularly noteworthy in this regard: First, the rank-order stability of personality traits (i.e., the maintenance of the relative rank of individuals on a trait over time) generally increases from childhood to adulthood (Briley & Tucker-Drob, 2014; Roberts & DelVecchio, 2000). Accordingly, childhood and adolescence are the phases of life with the lowest rank-order stabilities for personality traits (Roberts & DelVecchio, 2000).

Using 1-year time lags, Borghuis et al. (2017) found not only relatively low rank-order stabilities in early adolescence ( $r = .68$ ) but also increasing stabilities until late adolescence ( $r = .84$ ). At the same time, these results turned out to be highly robust across confounding variables such as gender, assessment method, and the respective personality trait under consideration. Thus, we still need to better understand what factors might contribute to this increase in rank-order stability across adolescence.

The second characteristic is mean-level change in personality (i.e., change in the average trait level over time), on which adolescents show developmental trends that differ from those of young adults (Soto & Tackett, 2015). To date, there is no general agreement about average trends in personality across adolescence. Whereas young adults generally become less neurotic, more agreeable, and more conscientious (maturity principle; Roberts et al., 2006), a temporary dip in these traits has been found in adolescence (disruption hypothesis; Borghuis et al., 2017; Denissen et al., 2013; Göllner, Roberts, et al., 2017; van den Akker et al., 2014). Specifically, the disruption hypothesis states that adolescents report a decline in socially relevant traits. One reason for such disruptive trends could be the attempt to become more autonomous and the rejection of norms previously defined by adults (Eisenberg & Morris, 2004). Other studies have been unable to support the disruption hypothesis because they showed either positive trends across time (Klimstra et al., 2009; Pullmann et al., 2006) or no mean-level changes (De Fruyt et al., 2006; McCrae et al., 2002). Thus, so far, no general agreement about personality trends across adolescence has been achieved. Importantly and in contrast to rank-order stabilities in personality, research has found substantial gender differences in mean-level changes with respect to neuroticism, openness, and conscientiousness (Borghuis et al., 2017), and girls were found to show a more mature personality in general (Göllner, Roberts, et al., 2017).

This unique adolescent pattern of relatively low rank-order stabilities and indefinite mean-level changes cannot be explained by most prominent theories of personality development, which is largely due to the fact that these theories describe personality development in (young) adulthood. However, theories about developmental tasks acknowledge that some tasks are age-specific and should thereby contribute to personality development (Hutteman et al., 2014). Also, the self-regulation theory by Denissen and colleagues (2013) provides initial suggestions about why personality shows a distinct change pattern during adolescence. According to this theory, personality traits change as functional reactions to environmental characteristics such as shifts in reference values due to social and demographic changes. Regarding developmental tasks and social shifts, peers become increasingly important

in adolescence as one way to seek independence from parents. In terms of demographic shifts, puberty causes huge biological changes in individuals. Thus, adolescents need to develop new behavioral and regulatory abilities and learn to use them. Practicing these additional behaviors to fulfill new social roles and to react to shifting reference values might then manifest in personality changes (Denissen et al., 2013).

Taken together, although research during the last two decades has focused on personality stability and change in adulthood, much more needs to be learned about adolescence, which has been characterized as a highly dynamic period that is particularly important for personality development. So far, it remains largely unknown how personality develops in adolescence and how such changes are related to other developmental processes (Soto & Tackett, 2015). Promising explanations can be found in the specific developmental tasks that occur in the context of school (Eccles, 2009; Eccles & Roeser, 2011; Roeser et al., 2009).

### **Development of School Experiences: Achievement, Social Relationships, and Well-Being**

Young people spend an large amount of time in school (Rutter et al., 1979) and develop a diverse set of new skills in multiple areas of academic, social, and emotional functioning (Eccles & Roeser, 2011; Weissberg et al., 2015). But while doing so, what kind of school experiences are significant enough to affect adolescents' personality development? Is there a longitudinal interplay between the manifold experiences students face and their personality traits?

Theoretical notions suggest (at least) three broader domains that might also contribute to the completion of developmental tasks: First, school achievement prepares students for work life (Hutteman et al., 2014); second, social relationships in school fulfill the general need to belong (Baumeister & Leary, 1995); and third, general well-being in school is a prerequisite for successful human functioning (Myers, 2000). Empirical evidence and the theoretical foundation for the importance of these three domains can also be found in self-determination theory (SDT; Deci & Ryan, 2000). The three basic psychological needs of competence, relatedness, and autonomy are part of everyday life in school and beyond and have been linked to achievement, social relationships, and well-being indicators (Gnambs & Hanfstingl, 2016; Ratelle et al., 2007; Ratelle & Duchesne, 2014; Tian et al., 2013; Tian et al., 2016). Accordingly, the differential longitudinal investigation of these domains in combination with personality might be one fruitful approach that can be applied to better understand developmental trajectories across adolescence. Specifically, we selected seven school



experiences that correspond to the three domains: first, GPA and German and mathematics competence tests (achievement); second, relationships with friends and teacher support (social relationships); and third, general well-being in school and school belonging (well-being). Before moving on to the potential interrelatedness between these experiences and personality development, we first briefly summarize how these school experiences change during adolescence.

Achievement (grades and objective achievement tests) has been found to be characterized by high rank-order stability but also substantial mean-level decreases during adolescence (Dotterer et al., 2009; Schunk & Pajares, 2002; Wang & Eccles, 2012). It appears that overall, students pay a little less attention to their academic performance in adolescence. By contrast, peer relationships gain importance during this time (Arnett, 2000; Sullivan, 1953). These shifts in reference values (Denissen et al., 2013) manifest in increasing friendship networks, more time spent with friends, and an increase in the stability and quality of friendships from early to late adolescence (Degirmencioglu et al., 1998; Poulin & Chan, 2010; Wagner et al., 2014; Way & Greene, 2006). Besides peer relationships, teachers remain important interaction partners in school (Engels et al., 2016; Hamre & Pianta, 2006). Teacher support has been found to be particularly beneficial for students' achievement, general school adjustment, and health (Aldrup et al., 2018; Wang et al., 2013). Notwithstanding the important role of teacher support, students' perceptions of teacher support have been mixed, ranging from no change (Engels et al., 2016; Song et al., 2015) to a decline in early and middle adolescence (Bru et al., 2010; Hughes & Cao, 2019; Way et al., 2007). Finally, there are few longitudinal studies that have investigated developmental trajectories of well-being in school, but the existing ones have pointed to a decline during adolescence (Coelho et al., 2020; Okun et al., 1990; Park, 2004). As a more specific aspect, school belonging, which describes the perceived connectedness of students to their school (Barber & Olson, 2004), has also been found to decline from early to middle adolescence (Perry & McIntire, 2001; Stanley et al., 2008; Wang & Eccles, 2012; Witherspoon & Ennett, 2011).

Altogether, results on school-related change trajectories have illustrated that performance requirements increase and achievement decreases, that social networks vary, and that peer relationships get more attention, whereas the enjoyment of school decreases (Arnett, 2000; Wang & Eccles, 2012). An open question is: To what extent do these changes co-occur with personality changes during adolescence?

## **The Interplay of Personality and School Experiences**

Given that both personality and school experiences change during adolescence, the consideration of their dynamic is the next logical step. Although cross-sectional research has linked personality with achievement (e.g., Brandt, Lechner et al., 2019; Poropat, 2009; Spengler et al., 2013), social relationships (e.g., Harris & Vazire, 2016; van Aken & Dubas, 2004; Zee et al., 2013), and well-being (e.g., Butkovic et al., 2012; Garcia, 2011) in adolescence, less is known about the longitudinal co-development and longitudinal predictive effects of adolescents' personality and school experiences over a time span of several years. Moreover, apart from a few exceptions, personality change has rarely been investigated as an outcome in educational research, but it has functioned mostly as a predictor of change in other variables. In the following, we will provide a brief overview of the current state of research on the longitudinal interplay between personality and achievement, social relationships, and well-being in school, respectively.

### ***Personality and Achievement***

Besides cognitive abilities, personality has been established as one of the strongest predictors of academic achievement (Borghans et al., 2016; Lechner et al., 2017; Poropat, 2009; Spengler et al., 2016). Similar to the cross-sectional findings, longitudinal studies have supported the crucial role of conscientiousness and openness for predicting academic achievement (e.g., Chamorro-Premuzic & Furnham, 2003; Heaven & Ciarrochi, 2008; Israel et al., 2019; Spengler et al., 2016; Trautwein et al., 2009).

Only a few studies have investigated the longitudinal interplay of academic achievement or engagement and personality during adolescence (Brandt, Mike, et al., 2019; Israel et al., 2019; Göllner, Damian, et al., 2017; Tackman et al., 2017), and most studies have focused exclusively on conscientiousness. In terms of academic achievement, researchers have found correlated changes in school grades and conscientiousness, whereas competence test results have been found to be associated with changes in conscientiousness and extraversion 2 years later (Israel et al., 2019; Tackman et al., 2017). With respect to students' achievement-related behaviors, results have been mixed: Homework effort was positively related to change in conscientiousness from fifth to eighth grade in a German study (Göllner, Damian, et al., 2017), whereas academic engagement was not associated with changes in impulse control, a facet of conscientiousness, in an American sample (Brandt, Mike, et al., 2019). So far, results do not allow for a final conclusion to be drawn about longitudinal personality-achievement

associations across adolescence. A more differentiated view on diverse achievement indicators and all Big Five personality traits is needed to disentangle these findings.

### ***Personality and Social Relationships***

Ample research has illustrated that personality traits play an important role in establishing and maintaining social relationships such as friendships or supportive teacher-student relationships (Harris & Vazire, 2016; Tackman et al., 2017; Wagner et al., 2014; Zee et al., 2013). Yet, most of this research has not focused on early to middle adolescence but rather on late adolescence and early adulthood.

Given the existing findings, three personality traits stand out with respect to the formation and maintenance of friendships: neuroticism, extraversion, and agreeableness (Jensen-Campbell et al., 2003; Harris & Vazire, 2016; Wagner et al., 2014). In studies with young adults, feeling insecure with friends was related to increases in facets of neuroticism and to decreases in extraversion (Deventer et al., 2019), whereas interactions with similarly extraverted friends were related to increases in extraversion later on (van Zalk et al., 2020). Moreover, more extraverted and agreeable young adults were found to tend to develop larger social networks (Wagner et al., 2014). By contrast, less is known about the longitudinal interrelatedness of personality and relevant school-related relationships in adolescence. Specifically, we are only aware of two studies that investigated the longitudinal interplay in adolescence of friendship relationships with conscientiousness (Tackman et al., 2017) or student-teacher relationships with impulse control (as a facet of conscientiousness; Brandt, Mike, et al., 2019). These studies provided mixed findings. One reported positive correlated change between conscientiousness and friends' supportive behavior between the ages of 10 and 16 (Tackman et al., 2017). The other found no correlated change between social relationship variables and impulse control from age 10 to 21 (Brandt, Mike, et al., 2019). However, some longitudinal cross-lagged effects with teacher support were found, but not with making friends: Whereas impulse control was not associated with changes in teacher support, perceptions of teacher support were associated with increases in impulse control between the ages of 14 and 16 (Brandt, Mike, et al., 2019). Overall, empirical evidence for the longitudinal interrelatedness of adolescent personality and relevant school-related social relationships is scarce.

### ***Personality and Well-Being***

In adolescence, the three personality traits of neuroticism, extraversion, and conscientiousness are particularly likely to contribute to subjective well-being (Anglim et al., 2020; Garcia, 2011; Moreira et al., 2015; Suldo et al., 2015; Weber & Huebner, 2015). More specifically, cross-sectional associations have illustrated that neuroticism is strongly correlated with emotional distress across studies, whereas extraversion and conscientiousness have shown moderate associations with pleasant affect (Evans et al., 2018; Garcia, 2011; Grav et al., 2012).

Again, only a few longitudinal studies have investigated how personality and well-being indicators are interrelated in adolescence (Brandt, Mike, et al., 2019; Borghuis et al., 2020; Evans et al., 2018; Tackman et al., 2017). One prospective study investigating effects of personality on well-being indicators 6 months later found that neuroticism and extraversion predicted subjective happiness, whereas conscientiousness predicted school satisfaction (Evans et al., 2018). Three studies also included personality longitudinally and were able to report on the longitudinal interrelatedness between personality and well-being: Changes in neuroticism between the ages of 13 and 18 were positively and bidirectionally associated with changes in negative affect (Borghuis et al., 2020), and changes in conscientiousness predicted increases in school satisfaction and climate (Brandt, Mike, et al., 2019; Tackman et al., 2017). We are not aware of any previous work that focused on the longitudinal interplay of personality and school belonging.

Overall, a limited number of studies have considered effects of school-related experiences to explain change in adolescents' personality. And the ones that have done so have often investigated samples in late adolescence, have used brief measures for the variables of interest, or did not include all five personality traits in their studies. Thus, evidence for a potential longitudinal interplay between personality and school experiences is still scarce. The current study contributes to a better understanding of the developmental patterns of psychosocial functioning with a focus on personality and school experiences in adolescence.

### **The Present Study**

In this study, we used four-wave longitudinal data covering early to mid-adolescence to address our main research question of how personality and relevant school experiences are interrelated in adolescence across time. We investigated this interplay by modeling correlated change using latent growth curve models and by examining longitudinal predictive cross-effects between personality and school experiences. Importantly, our study extends the

traditional route of personality–achievement associations by considering three relevant domains of psychosocial functioning in school and beyond: achievement, social relationships, and well-being. We preregistered all research questions and the analysis plan for the current study on the OSF ([https://osf.io/53yu9/?view\\_only=108ad6fcca024231b10fcccee37b5ad2](https://osf.io/53yu9/?view_only=108ad6fcca024231b10fcccee37b5ad2)).

We expected that all Big Five traits would be associated with achievement over time (Israel et al., 2019). However, in previous studies, the most consistent positive findings emerged for conscientiousness and openness (Spengler et al., 2016). Thus, we expected that more conscientious students would also show higher GPAs as well as better achievement test scores, whereas we expected that openness would be particularly strongly associated with higher achievement test scores over time. On the basis of initial empirical results indicating that achievement can also predict changes in conscientiousness and extraversion (Israel et al., 2019), we aimed to replicate these findings.

Regarding social relationships, our hypotheses were based primarily on previous cross-sectional findings (Harris & Vazire, 2016; Zee et al., 2013). We expected that neuroticism, extraversion, and agreeableness would show correlations across time (correlated change) with friendship and teacher support. Moreover, we expected that lower neuroticism, higher extraversion, and higher agreeableness would be related to increasing positive relationships with friends as well as to higher teacher support at subsequent assessments. According to the overall importance of social relationships in school, and given that particularly neuroticism and extraversion showed reciprocal effects with social relationships in young adulthood (e.g., Deventer et al., 2019; Mund & Neyer, 2014), we hypothesized that more positive friendship reports and higher teacher support would be related to decreasing neuroticism, whereas positive friendship reports would be additionally related to increasing extraversion.

We further anticipated correlated change in neuroticism, extraversion, and conscientiousness with well-being in school and with school belonging. Moreover, we expected that lower neuroticism, higher extraversion, and higher conscientiousness would be related to an increase in overall well-being in school and that, in particular, lower neuroticism and higher extraversion would predict higher ratings of school belonging (cf. Butkovic et al., 2012; Evans et al., 2018; Garcia, 2011). Finally, we hypothesized that the personality traits that have predicted well-being most consistently, namely, neuroticism and extraversion (e.g., Butkovic et al., 2012; Garcia, 2011), would also be predicted by well-being. Accordingly, we expected that higher ratings on general well-being in school and on school belonging would be related to lower neuroticism and to higher extraversion at subsequent time points.

## Method

We analyzed longitudinal data from the large-scale study “Tradition and Innovation in Educational Systems” (TRAIN), hosted by the Hector Research Institute for Education Sciences and Psychology at the University of Tübingen. The TRAIN study has focused in particular on the academic development of students in different school tracks (middle and lower track students) and has been executed in two German states (Saxony and Baden-Wuerttemberg). Data collection began right after the students transitioned from primary to secondary school in Grade 5 (T1) and was repeated at the beginning of the following three school years until Grade 8 (T4), resulting in four measurement points. As the data were collected between 2008 and 2011, this is considered a secondary analysis of existing data. The preregistration of the study can be found on OSF ([https://osf.io/53yu9/?view\\_only=108ad6fcca024231b10fcccee37b5ad2](https://osf.io/53yu9/?view_only=108ad6fcca024231b10fcccee37b5ad2)). Moreover, the following sections explain how we determined our sample size, the data exclusion strategies we applied, and instances in which our analytical approach differed from the preregistration. The code for all analyses and model results including the exact p-values and 99% confidence intervals are available on the OSF ([https://osf.io/zpf8r/?view\\_only=59a9ff41b281400aba1c13cd319a7aea](https://osf.io/zpf8r/?view_only=59a9ff41b281400aba1c13cd319a7aea)).

## Participants

The final sample consisted of 3,473 German students with an average age of 11.1 years ( $SD = 0.56$ ) at T1. Around 45% of all students were female, and 33% had an immigration status, that is, at least one parent was born outside of Germany. Students came from three nonacademic tracks: 43% of the students attended the *Hauptschule* (i.e., the lowest and least academically demanding track), 33% of the students attended the *Mittelschule* (i.e., multitrack schools ranked between the lowest academic track and the intermediate track), and 24% of the students attended the *Realschule* (i.e., the intermediate track and the most demanding track in the present study). From the original total sample (3,880 participants), we included all students who provided data at a minimum of one measurement point for personality and at a minimum of one measurement point for one of the other school-related key variables in our study (i.e., GPA, German language and math competence tests, friendship, teacher support, overall well-being in school, or school belonging). Personality trajectories from the TRAIN data have already been analyzed and published (Göllner, Roberts, et al., 2017). However, we are not

aware of any previous study or any type of statistical analyses on the above-defined variables and their possible longitudinal interplay.

When we compared the included ( $N = 3,473$ ) and the excluded participants ( $N = 407$ ), the analyses showed no significant differences (all  $ps > .01$ ) with respect to gender, school type, immigration status, socioeconomic status, or cognitive abilities. Further longitudinal attrition analyses showed that 61% of the students participated at all four measurement points, whereas 39% missed at least one TRAIN assessment. The students who took part in all waves were more likely to attend intermediate or multitrack schools ( $d = 0.41, p < .001$ ), were less likely to have an immigration status ( $d = -0.39, p < .001$ ), had better cognitive ability test results ( $d = 0.20, p < .001$ ), better grades ( $d = 0.31, p < .001$ ), and better achievement test results ( $d = 0.31$  for the German language test,  $d = 0.33$  for the mathematics achievement test, both effects  $p < .001$ ) than the students who missed at least one assessment point. Furthermore, the students who participated in all waves reported lower levels of neuroticism ( $d = -0.21, p < .001$ ) and higher levels of school belonging ( $d = 0.13, p = .007$ ). The two groups did not differ with respect to any other relevant variables. The existing differences between the two groups indicated a small to medium degree of selectivity that should be considered when interpreting the results.

## Measures

### *Personality*

Personality was measured with the German version (Lang et al., 2001) of the Big Five Inventory (BFI; John & Srivastava, 1999). Each of the 44 items was rated on a 5-point Likert scale ranging from 1 (*does not apply at all*) to 5 (*totally applies*). Following recent recommendations (Revelle & Condon, 2019), reliability was estimated using McDonald's  $\omega$  (McDonald, 1999) and was satisfactory for the five personality scales rated by students: .76/.73/.67/.69 (T1/T2/T3/T4) for neuroticism, .80/.70/.79/.83 for extraversion, .83/.84/.84/.84 for openness, .79/.74/.64/.67 for agreeableness, and .78/.75/.77/.63 for conscientiousness. Relatively low reliabilities compared with adult samples have already been reported in early adolescence and can be traced back to acquiescent responding (Göllner, Roberts, et al., 2017; Soto et al., 2008). Therefore, we controlled for such tendencies by including method factors in our models (see the analysis strategy).

### *Academic Achievement*

Students were asked to report their German and math grades from the last end-of-the-year school report. Grades were recoded so that higher values reflected higher achievement, with grades ranging from 1 (*insufficient*) to 6 (*very good*). We calculated GPA by taking the mean of the two grades. Research has shown that self-reported grades can be considered reliable and valid indicators of achievement (Dickhäuser & Plenter, 2005; Sanchez & Buddin, 2015).

Moreover, all students had to complete standardized achievement tests in the German language and mathematics covering standard content from the federal states' curricula in these subjects. The German language test focused on grade-specific reading comprehension such as reading short text passages and subsequently answering open or multiple-choice questions related to the text (for a more detailed description, see also Dumont et al., 2014). The mathematics test focused on diverse grade-specific mathematical content such as arithmetic rules, stochastics, or linear equations (see also Aldrup et al., 2018). All items had an open-ended, closed-ended, or multiple-choice format. Weighted Likelihood Estimates (WLEs; Warm, 1989) were provided for each student. Higher WLE values indicate higher achievement test scores. Unidimensionality, measurement invariance across different subpopulations (school type, gender), partial measurement invariance across measurement points (Jonkmann et al., 2013), reliability, and validity were ensured ( $\alpha = .70$  for both achievement domains).

### ***Social Relationships***

We used two different school-related social relationship indicators: relationships with friends and teacher support. Relationships with friends were assessed with the friends subscale from the KINDL-R questionnaire (Ravens-Sieberer et al., 2007; Ravens-Sieberer et al., 2001) on which students indicated whether they had seen friends during the last week and how well they got along with them. Students answered three questions about their friendships (e.g., “During the last week I got along well with my friends”) on a 5-point scale (1 = *never* to 5 = *always*). The internal consistency of the measure was good across all four assessment points: .72/.76/.77/.79 (T1/T2/T3/T4).

Teacher support was measured with a combination of items from the project “Cognitive Activation in the Classroom: The Orchestration of Learning Opportunities for the Enhancement of Insightful Learning in Mathematics” (COACTIV; Kunter et al., 2007), which integrates teacher support (e.g., “Our class teacher supports us in learning”) with teacher patience (e.g., “Our class teacher explains something until we understand it”). Overall, seven items were rated on a 4-point Likert scale ranging from 1 (*does not apply at all*) to 4 (*applies perfectly*). The



internal consistency of the scale was very good across all four measurement points: .88/.91/.92/.94 (T1/T2/T3/T4).

### **Well-Being**

We analyzed two different variables as well-being indicators in school: general well-being in school and school belonging. Well-being in school was assessed with five items (e.g., “School is a place I like to be”) from the project “Educational Careers and Psychosocial Development in Adolescence and Young Adulthood” (BIJU; Baumert et al., 1996). The items were answered on a 4-point Likert scale ranging from 1 (*does not apply at all*) to 4 (*applies perfectly*). The internal consistency of the measure was good at all four assessment points: .77/.80/.77/.77 (T1/T2/T3/T4).

To assess school belonging, students answered six questions about how (integrated) they feel in school on a 4-point Likert scale ranging from 1 (*does not apply at all*) to 4 (*applies perfectly*). One example item is “My school is a place where I seem to be popular.” The internal consistency of the measure was good across all four assessment points: .70/.79/.80/.83 (T1/T2/T3/T4).

### **Control Variables**

At the first measurement point, participants reported their gender (0 = *male* vs. 1 = *female*), school type (0 = *lower track schools “Hauptschule”* vs. 1 = *intermediate or multitrack schools “Mittelschule” or “Realschule”*), immigration status (0 = *no* vs. 1 = *yes*), socioeconomic status (SES), and general cognitive abilities. SES was measured with the International Socio-Economic Index (ISEI; Ganzeboom et al., 1992). General cognitive abilities were tested with the figural subtest from the Cognitive Ability Test (KFT, 4 – 12 R; Heller & Perleth, 2000). The psychometric properties of the test scores were very good: Reliability (measured with Cronbach’s  $\alpha$ ) was .90, which is also in line with the reliability estimates given in the manual for the KFT (Heller & Perleth, 2000).

Table 1 presents descriptive statistics for all manifest variables at all four measurement points. The manifest intercorrelations of all variables at T1 can be found in the online supplementary materials (Table OS1).

**Table 1***Descriptive Statistics for all Study Variables at Each Measurement Point T 1-4*

|                             |                      | T 1      |           |          |          | T 2      |           |          |          | T 3      |           |          |          | T 4      |           |          |          |
|-----------------------------|----------------------|----------|-----------|----------|----------|----------|-----------|----------|----------|----------|-----------|----------|----------|----------|-----------|----------|----------|
|                             |                      | <i>M</i> | <i>SD</i> | <i>n</i> | $\alpha$ | <i>M</i> | <i>SD</i> | <i>n</i> | $\alpha$ | <i>M</i> | <i>SD</i> | <i>n</i> | $\alpha$ | <i>M</i> | <i>SD</i> | <i>n</i> | $\alpha$ |
| <b>Personality</b>          | Neuroticism          | 2.81     | 0.57      | 2317     | 0.38     | 2.76     | 0.58      | 2382     | 0.51     | 2.74     | 0.60      | 2481     | 0.57     | 2.78     | 0.59      | 2503     | 0.58     |
|                             | Extraversion         | 3.37     | 0.61      | 2320     | 0.49     | 3.41     | 0.64      | 2387     | 0.63     | 3.47     | 0.66      | 2489     | 0.69     | 3.43     | 0.66      | 2508     | 0.73     |
|                             | Openness             | 3.38     | 0.54      | 2317     | 0.55     | 3.38     | 0.55      | 2382     | 0.62     | 3.34     | 0.55      | 2486     | 0.65     | 3.29     | 0.53      | 2508     | 0.64     |
|                             | Agreeableness        | 3.52     | 0.58      | 2319     | 0.44     | 3.52     | 0.58      | 2385     | 0.53     | 3.50     | 0.60      | 2487     | 0.60     | 3.45     | 0.59      | 2507     | 0.61     |
|                             | Conscientiousness    | 3.45     | 0.56      | 2321     | 0.52     | 3.41     | 0.58      | 2385     | 0.61     | 3.39     | 0.60      | 2485     | 0.68     | 3.30     | 0.58      | 2508     | 0.67     |
| <b>Achievement</b>          | GPA                  | 4.09     | 0.89      | 2572     |          | 4.06     | 0.70      | 2732     |          | 3.96     | 0.73      | 2782     |          | 3.95     | 0.74      | 2801     |          |
|                             | German language AT   | 0.46     | 1.01      | 2595     |          | 0.69     | 1.20      | 2563     |          | 0.97     | 1.25      | 2688     |          | 1.36     | 1.64      | 2657     |          |
|                             | Mathematics AT       | 0.67     | 1.09      | 2596     |          | 1.07     | 1.20      | 2554     |          | 1.53     | 1.20      | 2684     |          | 1.99     | 1.32      | 2659     |          |
| <b>Social relationships</b> | Friendship           | 3.84     | 0.89      | 2291     | 0.72     | 3.82     | 0.90      | 2370     | 0.76     | 3.94     | 0.86      | 2462     | 0.77     | 3.89     | 0.87      | 2480     | 0.79     |
|                             | Teacher support      | 3.29     | 0.63      | 2321     | 0.88     | 3.12     | 0.73      | 2399     | 0.91     | 3.13     | 0.73      | 2467     | 0.92     | 3.00     | 0.78      | 2506     | 0.94     |
| <b>Well-being</b>           | Well-being in school | 2.78     | 0.77      | 2117     | 0.77     | 2.58     | 0.77      | 2360     | 0.80     | 2.48     | 0.72      | 2456     | 0.77     | 2.39     | 0.69      | 2479     | 0.77     |
|                             | School belonging     | 3.19     | 0.60      | 2334     | 0.70     | 3.22     | 0.61      | 2391     | 0.79     | 3.28     | 0.58      | 2486     | 0.80     | 3.28     | 0.58      | 2488     | 0.83     |
| <b>Covariates</b>           | Gender               | 0.45     | 0.50      | 3473     |          |          |           |          |          |          |           |          |          |          |           |          |          |
|                             | Immigration status   | 0.33     | 0.47      | 3236     |          |          |           |          |          |          |           |          |          |          |           |          |          |
|                             | School type          | 0.57     | 0.49      | 3473     |          |          |           |          |          |          |           |          |          |          |           |          |          |
|                             | SES                  | 45.5     | 12.06     | 3188     |          |          |           |          |          |          |           |          |          |          |           |          |          |
|                             | Cognitive abilities  | 0.06     | 1.07      | 2604     |          |          |           |          |          |          |           |          |          |          |           |          |          |

*Note.* AT = Achievement Test. GPA = Grade Point Average. GPA was recoded so that higher numbers indicate better performance. The variables gender (1 = female), school type (1 = intermediate or multitrack schools), and immigration status (1 = yes) were dummy-coded.

## **Analytic Strategy**

To answer our research questions, we examined the longitudinal interplay between the Big Five personality traits and selected school experiences across four measurement points for each combination of personality trait and academic variable separately. All models are based on latent variable models. We proceeded in three steps: First, we tested for measurement invariance across time (MI; Little, 2013) in personality and all school-related outcomes with multiple indicators. These models also include tendencies to engage in acquiescent responding in early and middle adolescence and are considered the baseline models for all further analyses. Second, we estimated bivariate latent growth curve models (LGCMs; Bollen & Curran, 2006; McArdle, 2009) to investigate correlated changes. Third, we implemented cross-lagged panel models (CLPMs; Campbell & Kenny, 1999; Rogosa, 1988) to test for reciprocal dynamics between personality and school experiences across time. Both models represent well-established research methods in the context of longitudinal panel data with annual waves (e.g., Little, 2013), which gave us the opportunity to compare and integrate our findings with previous research. In addition, we added potential confounding variables (see our control variables) into the analytical models as time-invariant covariates.

We estimated all models with Mplus Version 8 (Muthén & Muthén, 2017) and evaluated the model fit using well-established model fit criteria: In addition to the  $\chi^2$  test statistic, which is known to be overly sensitive with increasing sample sizes, we included the comparative fit index (CFI), the root mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR). We considered the model fit acceptable or excellent, respectively, when the CFI was greater than .90 or .95, the RMSEA was below .08 or .05, and the SRMR was below .10 or .05 (Hu & Bentler, 1998; Marsh et al., 2005; Schermelleh-Engel et al., 2003). We dealt with missing values by applying the Full Maximum Likelihood estimator.

### ***Testing for Measurement Invariance Across Time and Acquiescence***

As the first step in the analysis, we tested for MI across time (fifth/sixth/seventh/eighth grade) to make sure that the observed changes were based on real changes in constructs and not on varying psychometric properties across time (Bollen & Curran, 2006). We intended to implement strong measurement invariance for each Big Five personality trait and all school experiences for which latent modeling was possible (friends, teacher support, well-being in

school, and school belonging) as the basis for mean-level comparisons. Thus, only GPA and academic achievement tests were included as manifest variables in our analyses.

Acquiescent responding—the tendency to agree with statements regardless of item content—is frequently observed when surveying children and adolescents (Soto et al., 2008). To control for this response tendency, we added an acquiescence method factor to all models that included negatively worded items (the Big Five, well-being in school, and school belonging). We used an approach that was similar to the one used by Göllner, Roberts, et al. (2017), who showed the appropriateness of this strategy with the TRAIN personality data. We used a time-point-specific acquiescence factor because the tendency to engage in acquiescent responding can change over time. As is usually done, we restricted all item loadings on the acquiescence factor to one. Moreover, we constrained the correlations between the latent personality traits and the latent school experiences, respectively, and we restricted the correlations with the acquiescence factors to zero.

In a stepwise fashion, we implemented strong measurement invariance for all of the aforementioned variables (i.e., loadings and intercepts were set equal across the four measurement points). Table OS2 in the online supplementary materials summarizes all the results.

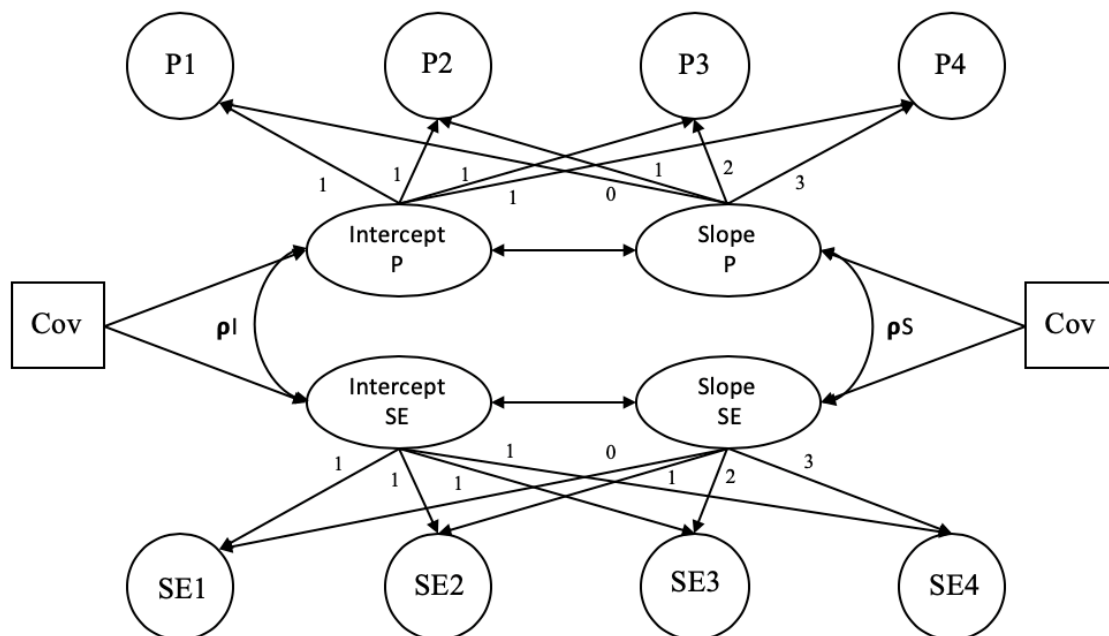
### ***Latent Growth Curve Models***

In the second step of the analysis, we estimated general latent developmental trends, that is, interindividual difference in intraindividual change and correlated change over time, using a bivariate second-order LGCM (Bollen & Curran, 2006; McArdle, 2009). With structural equation modeling techniques, we were able to control for measurement error at the indicator level and to distinguish structural relationships from measurement error (Bollen & Curran, 2006). On the basis of the strong measurement invariance model, we first implemented univariate LGCMs for each personality trait and each school-related experience, separately. The LGCM contains two additional latent factors, a latent intercept, and a linear slope: The intercept factor is defined by fixing all the loadings of the four time-point-specific latent indicators to one and represents the mean level of the variable at T1. The linear slope factor was identified by fixing the loadings so that they ranged from zero (at T1) to three (at T4), indicating a linear change trend. In a previous analysis of the TRAIN data, Göllner, Roberts, et al. (2017) already showed that nonlinear change patterns did not improve the fit statistics with respect to the Big Five personality traits. Correlations between the acquiescence factors and all other latent factors (latent variables as well as the intercept and slope factor) were set

to zero throughout all the analyses. We then estimated a bivariate LGCM that combined each personality growth curve model with each school variable growth curve model, respectively. Figure 1 shows a schematic representation of the structural part of the bivariate LGCM. These models contained one additional effect of interest: the correlation between the linear slope factors. This correlated change indicates whether the change processes in the Big Five and school experiences were interrelated across the duration of the study. We included covariates in all of the bivariate LGCMs that we estimated.

**Figure 1**

*Schematic Representation of the Structural Part of the Bivariate Latent Growth Curve Models*



*Note.* Squares denote manifest variables, and circles depict latent variables. This is a simplified representation; all personality and well-being models also contained an acquiescence factor. P = personality, SE = school experience, Cov = covariates,  $\rho$  = correlation between the intercepts and the slopes.

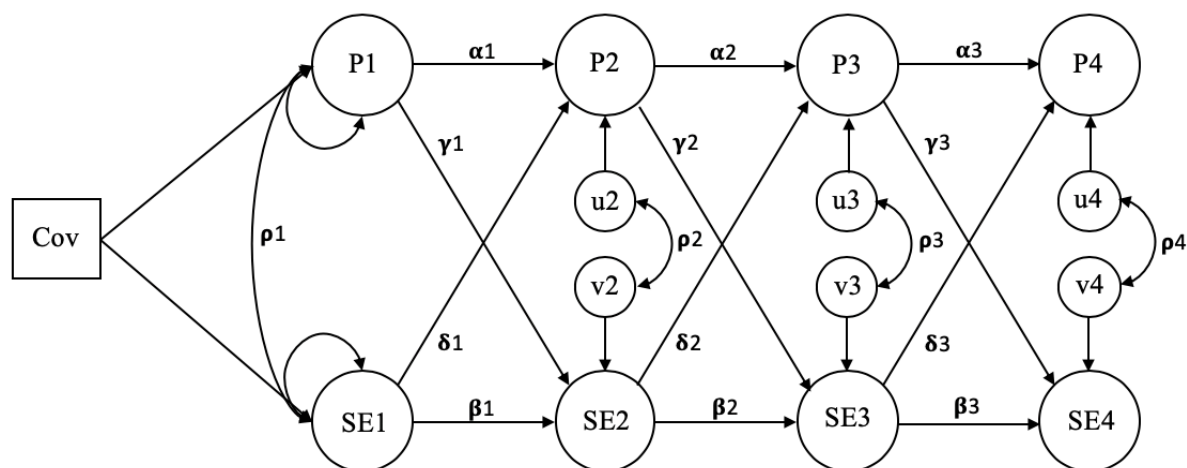
### ***Cross-Lagged Panel Models***

In the third step of the analysis, we calculated a CLPM (Campbell & Kenny, 1999; Rogosa, 1988), referring to our research aim of investigating time-lagged effects between the personality and school variables. Figure 2 presents a schematic representation of the structural part of the latent CLPM. These models were again based on the former strong measurement

invariance models with the acquiescence factor. We controlled for retest stability within constructs by including autoregressive paths (marked as  $\alpha$  and  $\beta$  in Figure 2 and in Tables 4 to 8). In these models, we were primarily interested in the cross-lagged effects (Campbell & Kenny, 1999; Rogosa, 1988) from each personality trait to each school variable at the subsequent measurement point (marked as  $\gamma$  in Figure 2 and in Tables 4 to 8) and vice versa (marked as  $\delta$  in Figure 2 and in Tables 4 to 8). These cross-lagged effects indicate the extent to which personality is related to subsequent school experiences from year to year while controlling for school experiences at the previous measurement point and vice versa. Moreover, we controlled for important covariates in each model. In order to find the most parsimonious models and to test for the time-specificity of the effects, we tested for whether the autoregressive and cross-lagged effects differed across assessment waves. Model comparisons were based on chi-square difference tests, and effects were treated as statistically different if  $\Delta\chi^2 \geq 9.21$  ( $df = 2, p < .01$ ). We report the findings from the final most parsimonious models in the Results section. All models can be retrieved from the OSF ([https://osf.io/zpf8r/?view\\_only=59a9ff41b281400aba1c13cd319a7aea](https://osf.io/zpf8r/?view_only=59a9ff41b281400aba1c13cd319a7aea)).

**Figure 2**

*Schematic Representation of the Structural Part of the Latent Cross-Lagged Panel Models*



*Note.* Squares denote manifest variables, and circles depict latent variables. This is a simplified representation; all personality and well-being models also contain an acquiescence factor. P = personality, SE = school experience, Cov = covariates,  $\alpha$  = 1-year autoregression of personality variable,  $\beta$  = 1-year autoregression of school experience,  $\gamma$  = 1-year cross-effect of personality on school-related experiences,  $\delta$  = 1-year cross-effect of school-related experience on personality,  $\rho$  = correlation between residuals.

## Results

In the following paragraphs, we summarize the longitudinal findings. First, we briefly describe the developmental trajectories of personality and school experiences from fifth to eighth grade. Second, we report initial correlations and correlated change between personality and the subsequent school-related experience (results of the bivariate LGCM). Third, we present cross-lagged effects of personality on later school experiences and vice versa (results of the CLPM). We only considered findings with  $p < .01$  significant. In addition, we report exact  $p$ -values to provide the reader with complete information. Due to the high complexity of the tables, the great number of models and therefore, a greater clarity we do report 99% confidence intervals of the effects in the online supplement tables OS 3 to 8.

### Developmental Trajectories of Personality and School Experiences

Table 2 presents the model fits and results of the univariate latent growth curve models for each personality trait as well as each school experience. All models provided an acceptable to excellent model fit. As also reported by Göllner, Roberts, et al. (2017), we found that all personality traits (except neuroticism) and all school experiences changed substantially (linear slopes with  $p < .01$ ) from fifth to eighth grade. Whereas extraversion increased slightly across time, openness, agreeableness, and conscientiousness decreased during the investigated time span. Regarding achievement, GPA also decreased, whereas achievement test results in German and math increased from fifth to eighth grade. Regarding social relationships in school, students reported more relationships with friends across time, whereas they experienced decreasing teacher support. In terms of well-being, students' school well-being decreased from fifth to eighth grade, but they showed slight increases in school belonging.

**Table 2***Univariate Latent Growth Curve Models for all Personality Traits and School-Related Experiences*

|                             |                      | Initial status               |          |                                |          | Change                       |          |                                |          | Model Fit      |           |      |       |      |
|-----------------------------|----------------------|------------------------------|----------|--------------------------------|----------|------------------------------|----------|--------------------------------|----------|----------------|-----------|------|-------|------|
|                             |                      | <i>M</i> <sub><i>t</i></sub> | <i>p</i> | $\sigma^2$ <sub><i>t</i></sub> | <i>p</i> | <i>M</i> <sub><i>s</i></sub> | <i>p</i> | $\sigma^2$ <sub><i>s</i></sub> | <i>p</i> | $\chi^2$       | <i>df</i> | CFI  | RMSEA | SRMR |
| <i>Personality</i>          | Neuroticism          | <b>2.22</b>                  | < .001   | <b>0.14</b>                    | < .001   | -0.00                        | .735     | <b>0.01</b>                    | < .001   | <b>1012.40</b> | 447       | .952 | .019  | .033 |
|                             | Extraversion         | <b>3.69</b>                  | < .001   | <b>0.11</b>                    | < .001   | <b>0.02</b>                  | < .001   | <b>0.01</b>                    | < .001   | <b>1294.00</b> | 447       | .946 | .023  | .040 |
|                             | Openness             | <b>3.82</b>                  | < .001   | <b>0.14</b>                    | < .001   | <b>-0.04</b>                 | < .001   | <b>0.01</b>                    | < .001   | <b>2676.98</b> | 885       | .925 | .024  | .039 |
|                             | Agreeableness        | <b>3.71</b>                  | < .001   | <b>0.11</b>                    | < .001   | <b>-0.02</b>                 | < .001   | <b>0.01</b>                    | < .001   | <b>1066.24</b> | 447       | .952 | .020  | .033 |
|                             | Conscientiousness    | <b>3.77</b>                  | < .001   | <b>0.28</b>                    | < .001   | <b>-0.07</b>                 | < .001   | <b>0.03</b>                    | < .001   | <b>1436.08</b> | 577       | .951 | .021  | .036 |
| <i>Achievement</i>          | GPA                  | <b>4.05</b>                  | < .001   | <b>0.46</b>                    | < .001   | <b>-0.06</b>                 | < .001   | <b>0.03</b>                    | < .001   | <b>54.86</b>   | 5         | .986 | .054  | .057 |
|                             | German language AT   | <b>0.45</b>                  | < .001   | <b>0.71</b>                    | < .001   | <b>0.26</b>                  | < .001   | <b>0.04</b>                    | < .001   | <b>17.19</b>   | 5         | .996 | .027  | .015 |
|                             | Mathematics AT       | <b>0.67</b>                  | < .001   | <b>0.88</b>                    | < .001   | <b>0.42</b>                  | < .001   | <b>0.03</b>                    | < .001   | 6.21           | 5         | 1    | .008  | .011 |
| <i>Social relationships</i> | Friendship           | <b>3.58</b>                  | < .001   | <b>0.28</b>                    | < .001   | <b>0.02</b>                  | .004     | <b>0.03</b>                    | < .001   | <b>206.09</b>  | 47        | .977 | .031  | .040 |
|                             | Teacher support      | <b>3.21</b>                  | < .001   | <b>0.21</b>                    | < .001   | <b>-0.09</b>                 | < .001   | <b>0.04</b>                    | < .001   | <b>1051.41</b> | 343       | .977 | .024  | .032 |
| <i>Well-being</i>           | Well-being in school | <b>2.69</b>                  | < .001   | <b>0.32</b>                    | < .001   | <b>-0.12</b>                 | < .001   | <b>0.03</b>                    | < .001   | <b>642.92</b>  | 153       | .960 | .031  | .040 |
|                             | School belonging     | <b>3.08</b>                  | < .001   | <b>0.14</b>                    | < .001   | <b>0.02</b>                  | < .001   | <b>0.01</b>                    | < .001   | <b>714.87</b>  | 235       | .964 | .024  | .040 |

*Note.* AT = Achievement Test. GPA = Grade Point Average. GPA was recoded so that higher numbers indicate better performance. The latent growth curve models with achievement were manifest. All personality and well-being models contained an acquiescence factor. Bold values were statistically significant at  $p < .01$ .



### **Bivariate Latent Growth Curve Models: Correlated Change Between Personality and School Experiences**

Table 3 provides an overview of the initial correlations (correlations between intercepts) and correlated change (correlations between slopes) between the Big Five personality traits and the seven school experiences. All reported models included the covariates gender, immigration status, school type, socioeconomic status, and cognitive abilities, and illustrated an acceptable model fit (all CFIs  $\geq .90$ , RMSEAs  $\leq .03$ , and SRMRs  $\leq .06$  except for one model with a CFI value that was slightly below the cut-off<sup>1</sup>).

#### ***Personality and Achievement***

We found statistically significant initial correlations between all the Big Five and the three achievement variables. Reporting a higher level of neuroticism was associated with lower achievement (GPA and test scores), whereas reporting higher levels of extraversion, openness, agreeableness, or conscientiousness was related to a higher GPA and better German and mathematics achievement test scores in fifth grade.

A more differentiated pattern emerged when we analyzed correlated change between personality and achievement. In line with our expectations, we observed correlated change between all Big Five traits and at least one achievement indicator. Change in conscientiousness showed a positive correlation with change in GPA, whereas surprisingly, only change in agreeableness was positively related to change in the German achievement test scores. The most consistent correlated changes with personality were found for the mathematics achievement test scores. Whereas change in neuroticism was negatively associated with change in the mathematics achievement test scores, change in openness, agreeableness, and conscientiousness was positively related to change in mathematics.

**Table 3***Bivariate Latent Growth Curve Models for Each Big Five Personality Factor Combined with Each School Experience*

|                             |                                      | Neuroticism |           |          | Extraversion |           |          | Openness   |           |          | Agreeableness |           |          | Conscientiousness |           |          |
|-----------------------------|--------------------------------------|-------------|-----------|----------|--------------|-----------|----------|------------|-----------|----------|---------------|-----------|----------|-------------------|-----------|----------|
|                             |                                      | <i>r</i>    | <i>SE</i> | <i>p</i> | <i>r</i>     | <i>SE</i> | <i>p</i> | <i>r</i>   | <i>SE</i> | <i>p</i> | <i>r</i>      | <i>SE</i> | <i>p</i> | <i>r</i>          | <i>SE</i> | <i>p</i> |
| <i>Achievement</i>          |                                      |             |           |          |              |           |          |            |           |          |               |           |          |                   |           |          |
| GPA                         | IPersonality × IGPA                  | <b>-.24</b> | 0.04      | < .001   | <b>.14</b>   | 0.04      | < .001   | <b>.12</b> | 0.04      | .004     | <b>.25</b>    | 0.04      | < .001   | <b>.34</b>        | 0.04      | < .001   |
|                             | SPersonality × SGPA                  | -.18        | 0.08      | .026     | .06          | 0.07      | .404     | .10        | 0.09      | .230     | .16           | 0.08      | .032     | <b>.34</b>        | 0.07      | < .001   |
| German language AT          | IPersonality × IGerman AT            | <b>-.32</b> | 0.04      | < .001   | <b>.29</b>   | 0.04      | < .001   | <b>.37</b> | 0.04      | < .001   | <b>.49</b>    | 0.04      | < .001   | <b>.24</b>        | 0.04      | < .001   |
|                             | SPersonality × SGerman AT            | -.26        | 0.11      | .017     | .18          | 0.09      | .044     | .04        | 0.11      | .732     | <b>.26</b>    | 0.10      | .009     | .14               | 0.08      | .102     |
| Mathematics AT              | IPersonality × IMathematics AT       | <b>-.24</b> | 0.04      | < .001   | <b>.19</b>   | 0.04      | < .001   | <b>.22</b> | 0.04      | < .001   | <b>.17</b>    | 0.04      | < .001   | <b>.17</b>        | 0.04      | < .001   |
|                             | SPersonality × SMathematics AT       | <b>-.44</b> | 0.11      | < .001   | .18          | 0.09      | .047     | <b>.31</b> | 0.10      | < .001   | <b>.31</b>    | 0.10      | .002     | <b>.35</b>        | 0.09      | < .001   |
| <i>Social relationships</i> |                                      |             |           |          |              |           |          |            |           |          |               |           |          |                   |           |          |
| Friendship                  | IPersonality × IFriendship           | <b>-.58</b> | 0.07      | < .001   | <b>.63</b>   | 0.06      | < .001   | <b>.52</b> | 0.07      | < .001   | <b>.41</b>    | 0.06      | < .001   | <b>.49</b>        | 0.06      | < .001   |
|                             | SPersonality × SFriendship           | <b>-.75</b> | 0.21      | < .001   | <b>.90</b>   | 0.22      | < .001   | <b>.77</b> | 0.23      | .001     | .34           | 0.14      | .018     | <b>.44</b>        | 0.14      | .002     |
| Teacher support             | IPersonality × ITeacher support      | <b>-.30</b> | 0.04      | < .001   | <b>.25</b>   | 0.04      | < .001   | <b>.47</b> | 0.05      | < .001   | <b>.40</b>    | 0.05      | < .001   | <b>.54</b>        | 0.04      | < .001   |
|                             | SPersonality × STeacher support      | <b>-.35</b> | 0.07      | < .001   | <b>.33</b>   | 0.06      | < .001   | <b>.74</b> | 0.10      | < .001   | <b>.48</b>    | 0.07      | < .001   | <b>.68</b>        | 0.07      | < .001   |
| <i>Well-being</i>           |                                      |             |           |          |              |           |          |            |           |          |               |           |          |                   |           |          |
| Well-being in school        | IPersonality × IWell-being in school | <b>-.50</b> | 0.04      | < .001   | <b>.27</b>   | 0.04      | < .001   | <b>.59</b> | 0.05      | < .001   | <b>.58</b>    | 0.04      | < .001   | <b>.81</b>        | 0.04      | < .001   |
|                             | SPersonality × SWell-being in school | <b>-.40</b> | 0.09      | < .001   | <b>.20</b>   | 0.07      | .003     | <b>.77</b> | 0.12      | < .001   | <b>.50</b>    | 0.08      | < .001   | <b>.84</b>        | 0.08      | < .001   |
| School belonging            | IPersonality × ISchool belonging     | <b>-.61</b> | 0.05      | < .001   | <b>.53</b>   | 0.04      | < .001   | <b>.28</b> | 0.05      | < .001   | <b>.40</b>    | 0.05      | < .001   | <b>.43</b>        | 0.04      | < .001   |
|                             | SPersonality × SSchool belonging     | <b>-.63</b> | 0.11      | < .001   | <b>.69</b>   | 0.09      | < .001   | <b>.29</b> | 0.10      | .003     | <b>.21</b>    | 0.08      | .006     | <b>.26</b>        | 0.07      | < .001   |
| <i>Model fit range</i>      |                                      |             |           |          |              |           |          |            |           |          |               |           |          |                   |           |          |
|                             | CFI                                  | .91-.95     |           |          | .91-.94      |           |          | .89-.93    |           |          | .92-.95       |           |          | .91-.95           |           |          |
|                             | RMSEA                                | .02-.03     |           |          | .02-.03      |           |          | .02-.03    |           |          | .02-.03       |           |          | .02               |           |          |
|                             | SRMR                                 | .04-.05     |           |          | .04-.06      |           |          | .05        |           |          | .04-.05       |           |          | .04-.05           |           |          |

*Note.* AT = Achievement Test, GPA = Grade Point Average, I = Intercept, S = Slope. GPA was recoded so that higher numbers indicate better performance. All personality and well-being models contained an acquiescence factor. All models were controlled for gender, immigration status, school type, SES, and cognitive abilities. Bold values were statistically significant at  $p < .01$ .

***Personality and Social Relationships***

All personality traits were initially related to relationships with friends and teacher support. Whereas neuroticism showed negative associations, higher levels in all other traits were related to better friendship relationships and more teacher support.

Regarding correlated change, neuroticism, extraversion, openness, and conscientiousness co-developed with friendship relationships. For neuroticism and extraversion, these results were in line with our expectations. Surprisingly—and not in line with our hypotheses—change in agreeableness was not associated with change in friendship relationships. Regarding teacher support, changes in all personality traits were related to change in teacher support. Thus, the results confirmed our hypotheses with respect to neuroticism, extraversion, and agreeableness but also extended these hypotheses with respect to the remaining traits.

***Personality and Well-Being***

All Big Five personality traits and both well-being indicators (i.e., well-being in school and school belonging) showed correlations at baseline. We found negative associations between neuroticism and well-being and positive associations for all other traits.

Furthermore, we found correlated change for all personality traits with well-being in school, extending our initial expectations for co-development exclusively for neuroticism, extraversion, and conscientiousness. Additionally, changes in all personality traits were related to change in school belonging. These results were in line with our hypotheses and were extended by the additional statistically significant correlated change with openness, agreeableness, and conscientiousness.

Summarizing our findings on bivariate latent growth curve models, personality and school experiences were found to largely co-develop during early adolescence. We found a more differentiated result pattern for correlated change between personality and achievement, whereas almost all Big Five personality traits co-developed with all experiences in the domains of social relationships and well-being. To further disentangle the longitudinal associations between personality and school experiences, we followed up on these results by modeling cross-lagged effects.

### **Cross-Lagged Panel Models: Longitudinal Cross-Effects of Personality and School Experiences**

Tables 4 to 8 present results for all CLPMs along with the stabilities across subsequent time points, correlations between initial levels and residuals at each time point, and model fits. The main effects of interest were the cross-lagged effects of personality on subsequent school experiences (indicated as  $\gamma$  in the tables) and the cross-lagged effects of school experiences on personality change (indicated as  $\delta$  in the tables). All models included the covariates gender, immigration status, school type, socioeconomic status, and cognitive abilities. The fit of all models was acceptable to excellent (all CFIs  $\geq .90$ , RMSEAs  $\leq .03$ , and SRMRs  $\leq .06$ , except for five models with CFIs that were slightly below the cut-off<sup>1</sup>).

#### ***Personality and Achievement***

**Personality Effects.** We found longitudinal associations from all Big Five traits on subsequent achievement. In line with our expectations, openness and conscientiousness revealed the most consistent findings with GPA as these two traits showed stable positive cross-effects across all time points. Higher openness and conscientiousness were related to better prospective grades from Grade 5 to Grade 8. Additionally, we found time-specific effects of neuroticism, extraversion, and agreeableness on GPA. Lower levels of neuroticism and higher levels of extraversion were related to higher GPA from fifth to sixth grade but not at subsequent time points. Interestingly, agreeableness also appeared to become less important across time but with a slightly different pattern: Being a more agreeable student was related to an increase in GPA at all time points, but these positive associations became statistically significantly smaller in later grades. With respect to personality effects on German language achievement test scores, we found that lower levels of neuroticism and higher levels of extraversion, openness, agreeableness, and conscientiousness were related to higher achievement 1 year later at all time points. However, only neuroticism and extraversion predicted prospectively lower and higher levels in mathematics achievement test scores, respectively. Not in line with our hypotheses, openness and conscientiousness showed no associations with subsequent mathematics achievement test scores.

**Achievement Effects.** We found two consistent effects on subsequent openness: Higher GPAs and better German achievement test scores predicted higher openness at all subsequent time points. However, against our expectations, we did not find achievement effects on extraversion or on conscientiousness.

**Table 4**  
Standardized Parameter Estimates in the CLPM for Neuroticism and School Experiences

|  | GPA         |          | German Language AT |          | Mathematics AT |          | Friends      |          | Teacher Support |          | Well-being at School |          | School Belonging |          |
|--|-------------|----------|--------------------|----------|----------------|----------|--------------|----------|-----------------|----------|----------------------|----------|------------------|----------|
|  | Est         | <i>p</i> | Est                | <i>p</i> | Est            | <i>p</i> | Est          | <i>p</i> | Est             | <i>p</i> | Est                  | <i>p</i> | Est              | <i>p</i> |
| <i>Stability effects</i>                   |             |          |                    |          |                |          |              |          |                 |          |                      |          |                  |          |
| $\alpha 1$                                 | <b>.62a</b> | <.001    | <b>.62a</b>        | <.001    | <b>.62a</b>    | <.001    | <b>.62a</b>  | <.001    | <b>.62a</b>     | <.001    | <b>.61a</b>          | <.001    | <b>.62a</b>      | <.001    |
| $\alpha 2$                                 | <b>.72a</b> | <.001    | <b>.71a</b>        | <.001    | <b>.71a</b>    | <.001    | <b>.70a</b>  | <.001    | <b>.71a</b>     | <.001    | <b>.70a</b>          | <.001    | <b>.71a</b>      | <.001    |
| $\alpha 3$                                 | <b>.68a</b> | <.001    | <b>.67a</b>        | <.001    | <b>.68a</b>    | <.001    | <b>.67a</b>  | <.001    | <b>.67a</b>     | <.001    | <b>.67a</b>          | <.001    | <b>.68a</b>      | <.001    |
| $\beta 1$                                  | <b>.56</b>  | <.001    | <b>.61</b>         | <.001    | <b>.66</b>     | <.001    | <b>.38b</b>  | <.001    | <b>.47</b>      | <.001    | <b>.64b</b>          | <.001    | <b>.54b</b>      | <.001    |
| $\beta 2$                                  | <b>.75</b>  | <.001    | <b>.61</b>         | <.001    | <b>.63</b>     | <.001    | <b>.43b</b>  | <.001    | <b>.39</b>      | <.001    | <b>.69b</b>          | <.001    | <b>.63b</b>      | <.001    |
| $\beta 3$                                  | <b>.71</b>  | <.001    | <b>.56</b>         | <.001    | <b>.63</b>     | <.001    | <b>.40b</b>  | <.001    | <b>.42</b>      | <.001    | <b>.69b</b>          | <.001    | <b>.57b</b>      | <.001    |
| <i>Cross-lagged effects</i>                |             |          |                    |          |                |          |              |          |                 |          |                      |          |                  |          |
| $\gamma 1$                                 | <b>-.20</b> | <.001    | <b>-.08b</b>       | <.001    | <b>-.04b</b>   | .003     | <b>-.10c</b> | <.001    | <b>-.06b</b>    | <.001    | -.01c                | .365     | <b>-.08c</b>     | <.001    |
| $\gamma 2$                                 | -.01        | .663     | <b>-.09b</b>       | <.001    | <b>-.05b</b>   | .003     | <b>-.12c</b> | <.001    | <b>-.07b</b>    | <.001    | -.02c                | .367     | <b>-.10c</b>     | <.001    |
| $\gamma 3$                                 | -.05        | .012     | <b>-.07b</b>       | <.001    | <b>-.04b</b>   | .003     | <b>-.12c</b> | <.001    | <b>-.07b</b>    | <.001    | -.02c                | .367     | <b>-.10c</b>     | <.001    |
| $\delta 1$                                 | -.00b       | .839     | -.03c              | .053     | -.02c          | .164     | <b>-.05d</b> | .005     | -.03c           | .032     | <b>-.05d</b>         | .002     | -.02d            | .358     |
| $\delta 2$                                 | -.00b       | .839     | -.03c              | .053     | -.02c          | .163     | <b>-.05d</b> | .005     | -.04c           | .032     | <b>-.05d</b>         | .002     | -.02d            | .357     |
| $\delta 3$                                 | -.00b       | .839     | -.03c              | .054     | -.02c          | .164     | <b>-.05d</b> | .005     | -.04c           | .031     | <b>-.05d</b>         | .002     | -.02d            | .359     |
| <i>Correlations / Correlated residuals</i> |             |          |                    |          |                |          |              |          |                 |          |                      |          |                  |          |
| $\rho 1$                                   | <b>-.10</b> | .001     | <b>-.21</b>        | <.001    | <b>-.14</b>    | <.001    | <b>-.29</b>  | <.001    | <b>-.22</b>     | <.001    | <b>-.38</b>          | <.001    | <b>-.43</b>      | <.001    |
| $\rho 2$                                   | -.02        | .530     | -.05               | .148     | -.01           | .875     | <b>-.29</b>  | <.001    | <b>-.13</b>     | .001     | <b>-.32</b>          | <.001    | <b>-.36</b>      | <.001    |
| $\rho 3$                                   | -.07        | .086     | -.08               | .040     | -.09           | .033     | <b>-.22</b>  | <.001    | <b>-.23</b>     | <.001    | <b>-.27</b>          | <.001    | <b>-.27</b>      | <.001    |
| $\rho 4$                                   | .00         | .995     | -.01               | .687     | -.08           | .021     | <b>-.21</b>  | <.001    | <b>-.17</b>     | <.001    | <b>-.18</b>          | <.001    | <b>-.27</b>      | <.001    |
| <i>Model fit</i>                           |             |          |                    |          |                |          |              |          |                 |          |                      |          |                  |          |
| $\chi^2$                                   | 2003.16     |          | 2328.51            |          | 2383.01        |          | 2537.86      |          | 3998.72         |          | 3347.39              |          | 3553.73          |          |
| df   | 740         |          | 742                |          | 742            |          | 1082         |          | 1968            |          | 1484                 |          | 1714             |          |
| CFI  | .92         |          | .89                |          | .89            |          | .92          |          | .95             |          | .92                  |          | .93              |          |
| RMSEA                                      | .03         |          | .03                |          | .03            |          | .02          |          | .02             |          | .02                  |          | .02              |          |
| SRMR                                       | .05         |          | .05                |          | .05            |          | .05          |          | .05             |          | .05                  |          | .04              |          |

*Note.* AT = Achievement Test. GPA = Grade Point Average. GPA was recoded so that higher numbers indicate better performance. All personality and well-being models contained an acquiescence factor.  $\alpha 1$ -3 show the 1-year stability effects of personality across the four measurement points,  $\beta 1$ -3 show the 1-year stability effects of the school-related experiences,  $\gamma 1$ -3 represent the cross-lagged effects from personality to the school-related experiences 1 year later,  $\delta 1$ -3 represent the cross-lagged effects of the school-related experiences on personality 1 year later,  $\rho 1$  represents the initial correlation between the personality trait and the school-related experiences,  $\rho 2$ -4 represent the correlated residuals at each measurement point. Indices a-d show whether the effects were set equal. All effects were controlled for gender, immigration status, school type, socioeconomic status, and cognitive abilities. Bold values show significant effects at a level of  $p < .01$ .

**Table 5**  
Standardized Parameter Estimates in the CLPM for Extraversion and School Experiences

|  | GPA         |          | German Language AT |          | Mathematics AT |          | Friends     |          | Teacher Support |          | Well-being at School |          | School Belonging |          |
|--|-------------|----------|--------------------|----------|----------------|----------|-------------|----------|-----------------|----------|----------------------|----------|------------------|----------|
|  | Est         | <i>p</i> | Est                | <i>p</i> | Est            | <i>p</i> | Est         | <i>p</i> | Est             | <i>p</i> | Est                  | <i>p</i> | Est              | <i>p</i> |
| <i>Stability effects</i>                   |             |          |                    |          |                |          |             |          |                 |          |                      |          |                  |          |
| $\alpha 1$                                 | <b>.68a</b> | <.001    | <b>.67a</b>        | <.001    | <b>.68a</b>    | <.001    | <b>.66a</b> | <.001    | <b>.68a</b>     | <.001    | <b>.67a</b>          | <.001    | <b>.65a</b>      | <.001    |
| $\alpha 2$                                 | <b>.72a</b> | <.001    | <b>.71a</b>        | <.001    | <b>.72a</b>    | <.001    | <b>.70a</b> | <.001    | <b>.72a</b>     | <.001    | <b>.70a</b>          | <.001    | <b>.70a</b>      | <.001    |
| $\alpha 3$                                 | <b>.71a</b> | <.001    | <b>.70a</b>        | <.001    | <b>.71a</b>    | <.001    | <b>.70a</b> | <.001    | <b>.71a</b>     | <.001    | <b>.70a</b>          | <.001    | <b>.69a</b>      | <.001    |
| $\beta 1$                                  | <b>.59</b>  | <.001    | <b>.61</b>         | <.001    | <b>.66</b>     | <.001    | <b>.37b</b> | <.001    | <b>.48</b>      | <.001    | <b>.64b</b>          | <.001    | <b>.53b</b>      | <.001    |
| $\beta 2$                                  | <b>.74</b>  | <.001    | <b>.61</b>         | <.001    | <b>.64</b>     | <.001    | <b>.41b</b> | <.001    | <b>.40</b>      | <.001    | <b>.69b</b>          | <.001    | <b>.62b</b>      | <.001    |
| $\beta 3$                                  | <b>.72</b>  | <.001    | <b>.56</b>         | <.001    | <b>.63</b>     | <.001    | <b>.38b</b> | <.001    | <b>.44</b>      | <.001    | <b>.69b</b>          | <.001    | <b>.55b</b>      | <.001    |
| <i>Cross-lagged effects</i>                |             |          |                    |          |                |          |             |          |                 |          |                      |          |                  |          |
| $\gamma 1$                                 | <b>.12</b>  | <.001    | <b>.08b</b>        | <.001    | <b>.03b</b>    | .004     | <b>.14c</b> | <.001    | -.01b           | .688     | .02c                 | .150     | <b>.11c</b>      | <.001    |
| $\gamma 2$                                 | .03         | .102     | <b>.08b</b>        | <.001    | <b>.04b</b>    | .004     | <b>.16c</b> | <.001    | -.01b           | .688     | .02c                 | .151     | <b>.13c</b>      | <.001    |
| $\gamma 3$                                 | .03         | .069     | <b>.07b</b>        | <.001    | <b>.04b</b>    | .004     | <b>.17c</b> | <.001    | -.01b           | .688     | .03c                 | .151     | <b>.13c</b>      | <.001    |
| $\delta 1$                                 | -.00b       | .829     | .02c               | .068     | -.00c          | .908     | <b>.05d</b> | .003     | .01c            | .504     | <b>.07d</b>          | <.001    | <b>.06d</b>      | .002     |
| $\delta 2$                                 | -.00b       | .829     | .03c               | .069     | -.00c          | .908     | <b>.05d</b> | .003     | .01c            | .505     | <b>.06d</b>          | <.001    | <b>.06d</b>      | .002     |
| $\delta 3$                                 | -.00b       | .828     | .03c               | .070     | -.00c          | .908     | <b>.05d</b> | .003     | .01c            | .504     | <b>.05d</b>          | <.001    | <b>.05d</b>      | .003     |
| <i>Correlations / Correlated residuals</i> |             |          |                    |          |                |          |             |          |                 |          |                      |          |                  |          |
| $\rho 1$                                   | <b>.07</b>  | .007     | <b>.20</b>         | <.001    | <b>.12</b>     | <.001    | <b>.33</b>  | <.001    | <b>.18</b>      | <.001    | <b>.19</b>           | <.001    | <b>.37</b>       | <.001    |
| $\rho 2$                                   | .02         | .662     | .09                | .012     | -.08           | .019     | <b>.31</b>  | <.001    | <b>.16</b>      | <.001    | <b>.17</b>           | <.001    | <b>.28</b>       | <.001    |
| $\rho 3$                                   | .01         | .767     | .03                | .469     | .08            | .015     | <b>.24</b>  | <.001    | <b>.23</b>      | <.001    | <b>.15</b>           | .001     | <b>.28</b>       | <.001    |
| $\rho 4$                                   | .00         | .895     | .03                | .307     | .04            | .216     | <b>.25</b>  | <.001    | <b>.12</b>      | .002     | .08                  | .057     | <b>.31</b>       | <.001    |
| <i>Model fit</i>                           |             |          |                    |          |                |          |             |          |                 |          |                      |          |                  |          |
| $\chi^2$                                   | 2354.18     |          | 2491.80            |          | 2638.27        |          | 2882.75     |          | 4448.46         |          | 3788.80              |          | 3828.17          |          |
| df   | 740         |          | 742                |          | 742            |          | 1082        |          | 1968            |          | 1484                 |          | 1714             |          |
| CFI  | .91         |          | .90                |          | .90            |          | .91         |          | .94             |          | .91                  |          | .92              |          |
| RMSEA                                      | .03         |          | .03                |          | .03            |          | .03         |          | .02             |          | .03                  |          | .02              |          |
| SRMR                                       | .05         |          | .05                |          | .05            |          | .05         |          | .06             |          | .06                  |          | .05              |          |

*Note.* AT = Achievement Test. GPA = Grade Point Average. GPA was recoded so that higher numbers indicate better performance. All personality and well-being models contained an acquiescence factor.  $\alpha 1$ -3 show the 1-year stability effects of personality across the four measurement points,  $\beta 1$ -3 show the 1-year stability effects of the school-related experiences,  $\gamma 1$ -3 represent the cross-lagged effects from personality to the school-related experiences 1 year later,  $\delta 1$ -3 represent the cross-lagged effects of the school-related experiences on personality 1 year later,  $\rho 1$  represents the initial correlation between the personality trait and the school-related experiences,  $\rho 2$ -4 represent the correlated residuals at each measurement point. Indices a-d show whether the effects were set equal. All effects were controlled for gender, immigration status, school type, socioeconomic status, and cognitive abilities. Bold values show significant effects at a level of  $p < .01$ .

**Table 6**  
Standardized Parameter Estimates in the CLPM for Openness and School Experiences

|  | GPA         |          | German Language AT |          | Mathematics AT |          | Friends     |          | Teacher Support |          | Well-being at School |          | School Belonging |          |
|--|-------------|----------|--------------------|----------|----------------|----------|-------------|----------|-----------------|----------|----------------------|----------|------------------|----------|
|  | Est         | <i>p</i> | Est                | <i>p</i> | Est            | <i>p</i> | Est         | <i>p</i> | Est             | <i>p</i> | Est                  | <i>p</i> | Est              | <i>p</i> |
| <i>Stability effects</i>                   |             |          |                    |          |                |          |             |          |                 |          |                      |          |                  |          |
| $\alpha 1$                                 | <b>.65a</b> | <.001    | <b>.65a</b>        | <.001    | <b>.65a</b>    | <.001    | <b>.65a</b> | <.001    | <b>.66a</b>     | <.001    | <b>.65a</b>          | <.001    | <b>.66a</b>      | <.001    |
| $\alpha 2$                                 | <b>.71a</b> | <.001    | <b>.70a</b>        | <.001    | <b>.71a</b>    | <.001    | <b>.71a</b> | <.001    | <b>.72a</b>     | <.001    | <b>.71a</b>          | <.001    | <b>.72a</b>      | <.001    |
| $\alpha 3$                                 | <b>.71a</b> | <.001    | <b>.70a</b>        | <.001    | <b>.71a</b>    | <.001    | <b>.71a</b> | <.001    | <b>.72a</b>     | <.001    | <b>.72a</b>          | <.001    | <b>.72a</b>      | <.001    |
| $\beta 1$                                  | <b>.60</b>  | <.001    | <b>.61</b>         | <.001    | <b>.67</b>     | <.001    | <b>.39b</b> | <.001    | <b>.46</b>      | <.001    | <b>.63b</b>          | <.001    | <b>.57b</b>      | <.001    |
| $\beta 2$                                  | <b>.74</b>  | <.001    | <b>.60</b>         | <.001    | <b>.64</b>     | <.001    | <b>.44b</b> | <.001    | <b>.39</b>      | <.001    | <b>.68b</b>          | <.001    | <b>.66b</b>      | <.001    |
| $\beta 3$                                  | <b>.71</b>  | <.001    | <b>.55</b>         | <.001    | <b>.63</b>     | <.001    | <b>.41b</b> | <.001    | <b>.43</b>      | <.001    | <b>.68b</b>          | <.001    | <b>.59b</b>      | <.001    |
| <i>Cross-lagged effects</i>                |             |          |                    |          |                |          |             |          |                 |          |                      |          |                  |          |
| $\gamma 1$                                 | <b>.08b</b> | <.001    | <b>.09b</b>        | <.001    | .03b           | .039     | <b>.10c</b> | <.001    | .04b            | .057     | .03c                 | .064     | <b>.07c</b>      | <.001    |
| $\gamma 2$                                 | <b>.08b</b> | <.001    | <b>.09b</b>        | <.001    | .03b           | .039     | <b>.12c</b> | <.001    | .04b            | .060     | .04c                 | .065     | <b>.08c</b>      | <.001    |
| $\gamma 3$                                 | <b>.08b</b> | <.001    | <b>.07b</b>        | <.001    | .03b           | .040     | <b>.12c</b> | <.001    | .04b            | .059     | .04c                 | .066     | <b>.08c</b>      | <.001    |
| $\delta 1$                                 | <b>.05c</b> | .002     | <b>.03c</b>        | .009     | .03c           | .033     | .01d        | .510     | -.04c           | .023     | .01d                 | .619     | -.01d            | .425     |
| $\delta 2$                                 | <b>.04c</b> | .002     | <b>.04c</b>        | .009     | .03c           | .032     | .01d        | .510     | -.04c           | .022     | .01d                 | .618     | -.02d            | .425     |
| $\delta 3$                                 | <b>.04c</b> | .002     | <b>.04c</b>        | .009     | .03c           | .033     | .01d        | .511     | -.04c           | .022     | .01d                 | .619     | -.01d            | .423     |
| <i>Correlations / Correlated residuals</i> |             |          |                    |          |                |          |             |          |                 |          |                      |          |                  |          |
| $\rho 1$                                   | .05         | .094     | <b>.25</b>         | <.001    | <b>.14</b>     | <.001    | <b>.27</b>  | <.001    | <b>.34</b>      | <.001    | <b>.41</b>           | <.001    | <b>.20</b>       | <.001    |
| $\rho 2$                                   | .06         | .111     | .04                | .279     | .03            | .520     | <b>.18</b>  | <.001    | <b>.33</b>      | <.001    | <b>.36</b>           | <.001    | .10              | .028     |
| $\rho 3$                                   | -.01        | .897     | .04                | .298     | .03            | .393     | <b>.13</b>  | .008     | <b>.36</b>      | <.001    | <b>.33</b>           | <.001    | .09              | .074     |
| $\rho 4$                                   | .07         | .059     | .05                | .217     | <b>.13</b>     | .001     | .07         | .133     | <b>.33</b>      | <.001    | <b>.19</b>           | .001     | .08              | .107     |
| <i>Model fit</i>                           |             |          |                    |          |                |          |             |          |                 |          |                      |          |                  |          |
| $\chi^2$                                   | 3893.96     |          | 4178.19            |          | 4235.56        |          | 4524.11     |          | 6206.79         |          | 5651.58              |          | 5598.03          |          |
| df   | 1288        |          | 1288               |          | 1288           |          | 1724        |          | 2802            |          | 2222                 |          | 2500             |          |
| CFI  | .90         |          | .88                |          | .88            |          | .90         |          | .93             |          | .90                  |          | .91              |          |
| RMSEA                                      | .03         |          | .03                |          | .03            |          | .03         |          | .02             |          | .03                  |          | .02              |          |
| SRMR                                       | .05         |          | .05                |          | .05            |          | .05         |          | .05             |          | .05                  |          | .05              |          |

*Note.* AT = Achievement Test. GPA = Grade Point Average. GPA was recoded so that higher numbers indicate better performance. All personality and well-being models contained an acquiescence factor.  $\alpha 1$ -3 show the 1-year stability effects of personality across the four measurement points,  $\beta 1$ -3 show the 1-year stability effects of the school-related experiences,  $\gamma 1$ -3 represent the cross-lagged effects from personality to the school-related experiences 1 year later,  $\delta 1$ -3 represent the cross-lagged effects of the school-related experiences on personality 1 year later,  $\rho 1$  represents the initial correlation between the personality trait and the school-related experiences,  $\rho 2$ -4 represent the correlated residuals at each measurement point. Indices a-d show whether the effects were set equal. All effects were controlled for gender, immigration status, school type, socioeconomic status, and cognitive abilities. Bold values show significant effects at a level of  $p < .01$ .

**Table 7**  
Standardized Parameter Estimates in the CLPM for Agreeableness and School Experiences

|  | GPA         |          | German Language AT |          | Mathematics AT |          | Friends     |          | Teacher Support |          | Well-being at School |          | School Belonging |          |
|--|-------------|----------|--------------------|----------|----------------|----------|-------------|----------|-----------------|----------|----------------------|----------|------------------|----------|
|  | Est         | <i>p</i> | Est                | <i>p</i> | Est            | <i>p</i> | Est         | <i>p</i> | Est             | <i>p</i> | Est                  | <i>p</i> | Est              | <i>p</i> |
| <i>Stability effects</i>                   |             |          |                    |          |                |          |             |          |                 |          |                      |          |                  |          |
| $\alpha 1$                                 | <b>.72a</b> | <.001    | <b>.73a</b>        | <.001    | <b>.73a</b>    | <.001    | <b>.73a</b> | <.001    | <b>.73a</b>     | <.001    | <b>.70a</b>          | <.001    | <b>.73a</b>      | <.001    |
| $\alpha 2$                                 | <b>.69a</b> | <.001    | <b>.70a</b>        | <.001    | <b>.70a</b>    | <.001    | <b>.70a</b> | <.001    | <b>.69a</b>     | <.001    | <b>.67a</b>          | <.001    | <b>.70a</b>      | <.001    |
| $\alpha 3$                                 | <b>.73a</b> | <.001    | <b>.73a</b>        | <.001    | <b>.74a</b>    | <.001    | <b>.74a</b> | <.001    | <b>.73a</b>     | <.001    | <b>.71a</b>          | <.001    | <b>.73a</b>      | <.001    |
| $\beta 1$                                  | <b>.57</b>  | <.001    | <b>.58</b>         | <.001    | <b>.67</b>     | <.001    | <b>.41b</b> | <.001    | <b>.45</b>      | <.001    | <b>.64b</b>          | <.001    | <b>.57b</b>      | <.001    |
| $\beta 2$                                  | <b>.73</b>  | <.001    | <b>.57</b>         | <.001    | <b>.64</b>     | <.001    | <b>.45b</b> | <.001    | <b>.38</b>      | <.001    | <b>.69b</b>          | <.001    | <b>.66b</b>      | <.001    |
| $\beta 3$                                  | <b>.71</b>  | <.001    | <b>.53</b>         | <.001    | <b>.63</b>     | <.001    | <b>.42b</b> | <.001    | <b>.41</b>      | <.001    | <b>.68b</b>          | <.001    | <b>.59b</b>      | <.001    |
| <i>Cross-lagged effects</i>                |             |          |                    |          |                |          |             |          |                 |          |                      |          |                  |          |
| $\gamma 1$                                 | <b>.21</b>  | <.001    | <b>.15b</b>        | <.001    | .04b           | .001     | .01         | .847     | <b>.09b</b>     | <.001    | .02c                 | .263     | <b>.06c</b>      | <.001    |
| $\gamma 2$                                 | <b>.09</b>  | <.001    | <b>.15b</b>        | <.001    | .04b           | .001     | <b>.10</b>  | .001     | <b>.09b</b>     | <.001    | .02c                 | .263     | <b>.07c</b>      | <.001    |
| $\gamma 3$                                 | <b>.08</b>  | <.001    | <b>.12b</b>        | <.001    | .04b           | .001     | <b>.15</b>  | <.001    | <b>.09b</b>     | <.001    | .02c                 | .362     | <b>.07c</b>      | <.001    |
| $\delta 1$                                 | .02b        | .314     | .00c               | .773     | -.02c          | .134     | -.00c       | .925     | .00c            | .814     | <b>.06d</b>          | .001     | .00d             | .892     |
| $\delta 2$                                 | .01b        | .313     | .00c               | .773     | -.02c          | .134     | -.00c       | .925     | .00c            | .813     | <b>.06d</b>          | .001     | .00d             | .892     |
| $\delta 3$                                 | .01b        | .315     | .00c               | .773     | -.02c          | .133     | -.00c       | .925     | .00c            | .813     | <b>.06d</b>          | .001     | .00d             | .892     |
| <i>Correlations / Correlated residuals</i> |             |          |                    |          |                |          |             |          |                 |          |                      |          |                  |          |
| $\rho 1$                                   | <b>.09</b>  | .001     | <b>.31</b>         | <.001    | <b>.11</b>     | <.001    | <b>.25</b>  | <.001    | <b>.26</b>      | <.001    | <b>.41</b>           | <.001    | <b>.29</b>       | <.001    |
| $\rho 2$                                   | .04         | .269     | <b>.10</b>         | .008     | .02            | .612     | <b>.20</b>  | <.001    | <b>.23</b>      | <.001    | <b>.36</b>           | <.001    | <b>.18</b>       | <.001    |
| $\rho 3$                                   | .01         | .720     | <b>.10</b>         | .003     | <b>.09</b>     | .008     | .06         | .174     | <b>.33</b>      | <.001    | <b>.31</b>           | <.001    | .11              | .012     |
| $\rho 4$                                   | .01         | .710     | .04                | .276     | <b>.10</b>     | .003     | .05         | .268     | <b>.21</b>      | <.001    | <b>.23</b>           | <.001    | <b>.12</b>       | .005     |
| <i>Model fit</i>                           |             |          |                    |          |                |          |             |          |                 |          |                      |          |                  |          |
| $\chi^2$                                   | 2037.74     |          | 2294.49            |          | 2475.22        |          | 2805.97     |          | 4038.90         |          | 3404.69              |          | 3552.25          |          |
| df   | 740         |          | 742                |          | 742            |          | 1080        |          | 1968            |          | 1484                 |          | 1714             |          |
| CFI  | .92         |          | .90                |          | .89            |          | .91         |          | .95             |          | .92                  |          | .93              |          |
| RMSEA                                      | .03         |          | .03                |          | .03            |          | .03         |          | .02             |          | .02                  |          | .02              |          |
| SRMR                                       | .05         |          | .05                |          | .05            |          | .05         |          | .05             |          | .05                  |          | .04              |          |

*Note.* AT = Achievement Test. GPA = Grade Point Average. GPA was recoded so that higher numbers indicate better performance. All personality and well-being models contained an acquiescence factor.  $\alpha 1$ -3 show the 1-year stability effects of personality across the four measurement points,  $\beta 1$ -3 show the 1-year stability effects of the school-related experiences,  $\gamma 1$ -3 represent the cross-lagged effects from personality to the school-related experiences 1 year later,  $\delta 1$ -3 represent the cross-lagged effects of the school-related experiences on personality 1 year later,  $\rho 1$  represents the initial correlation between the personality trait and the school-related experiences,  $\rho 2$ -4 represent the correlated residuals at each measurement point. Indices a-d show whether the effects were set equal. All effects were controlled for gender, immigration status, school type, socioeconomic status, and cognitive abilities. Bold values show significant effects at a level of  $p < .01$ .



**Table 8**  
Standardized Parameter Estimates in the CLPM for Conscientiousness and School Experiences

|  | GPA         |          | German Language AT |          | Mathematics AT |          | Friends     |          | Teacher Support |          | Well-being at School |          | School Belonging |          |
|--|-------------|----------|--------------------|----------|----------------|----------|-------------|----------|-----------------|----------|----------------------|----------|------------------|----------|
|  | Est         | <i>p</i> | Est                | <i>p</i> | Est            | <i>p</i> | Est         | <i>p</i> | Est             | <i>p</i> | Est                  | <i>p</i> | Est              | <i>p</i> |
| <i>Stability effects</i>                   |             |          |                    |          |                |          |             |          |                 |          |                      |          |                  |          |
| $\alpha 1$                                 | <b>.67a</b> | <.001    | <b>.68a</b>        | <.001    | <b>.68a</b>    | <.001    | <b>.67a</b> | <.001    | <b>.68a</b>     | <.001    | <b>.64a</b>          | <.001    | <b>.68a</b>      | <.001    |
| $\alpha 2$                                 | <b>.70a</b> | <.001    | <b>.71a</b>        | <.001    | <b>.71a</b>    | <.001    | <b>.70a</b> | <.001    | <b>.70a</b>     | <.001    | <b>.65a</b>          | <.001    | <b>.70a</b>      | <.001    |
| $\alpha 3$                                 | <b>.72a</b> | <.001    | <b>.72a</b>        | <.001    | <b>.72a</b>    | <.001    | <b>.72a</b> | <.001    | <b>.72a</b>     | <.001    | <b>.68a</b>          | <.001    | <b>.72a</b>      | <.001    |
| $\beta 1$                                  | <b>.58</b>  | <.001    | <b>.62</b>         | <.001    | <b>.67</b>     | <.001    | <b>.39b</b> | <.001    | <b>.44</b>      | <.001    | <b>.61b</b>          | <.001    | <b>.56b</b>      | <.001    |
| $\beta 2$                                  | <b>.72</b>  | <.001    | <b>.61</b>         | <.001    | <b>.64</b>     | <.001    | <b>.44b</b> | <.001    | <b>.37</b>      | <.001    | <b>.65b</b>          | <.001    | <b>.64b</b>      | <.001    |
| $\beta 3$                                  | <b>.69</b>  | <.001    | <b>.56</b>         | <.001    | <b>.63</b>     | <.001    | <b>.41b</b> | <.001    | <b>.40</b>      | <.001    | <b>.64b</b>          | <.001    | <b>.58b</b>      | <.001    |
| <i>Cross-lagged effects</i>                |             |          |                    |          |                |          |             |          |                 |          |                      |          |                  |          |
| $\gamma 1$                                 | <b>.12b</b> | <.001    | <b>.09b</b>        | <.001    | .03b           | .031     | <b>.12c</b> | <.001    | <b>.10b</b>     | <.001    | <b>.07c</b>          | <.001    | <b>.10c</b>      | <.001    |
| $\gamma 2$                                 | <b>.12b</b> | <.001    | <b>.09b</b>        | <.001    | .03b           | .031     | <b>.14c</b> | <.001    | <b>.10b</b>     | <.001    | <b>.08c</b>          | <.001    | <b>.11c</b>      | <.001    |
| $\gamma 3$                                 | <b>.12b</b> | <.001    | <b>.07b</b>        | <.001    | .03b           | .031     | <b>.14c</b> | <.001    | <b>.10b</b>     | <.001    | <b>.08c</b>          | <.001    | <b>.11c</b>      | <.001    |
| $\delta 1$                                 | .03c        | .039     | .01c               | .582     | .01c           | .548     | .02d        | .146     | .01c            | .429     | <b>.09d</b>          | <.001    | .00d             | .772     |
| $\delta 2$                                 | .02c        | .039     | .01c               | .582     | .01c           | .548     | .02d        | .146     | .01c            | .428     | <b>.08d</b>          | <.001    | .01d             | .772     |
| $\delta 3$                                 | .02c        | .040     | .01c               | .582     | .01c           | .549     | .02d        | .147     | .01c            | .429     | <b>.08d</b>          | <.001    | .00d             | .772     |
| <i>Correlations / Correlated residuals</i> |             |          |                    |          |                |          |             |          |                 |          |                      |          |                  |          |
| $\rho 1$                                   | <b>.16</b>  | <.001    | <b>.16</b>         | <.001    | <b>.12</b>     | <.001    | <b>.28</b>  | <.001    | <b>.36</b>      | <.001    | <b>.58</b>           | <.001    | <b>.33</b>       | <.001    |
| $\rho 2$                                   | <b>.13</b>  | <.001    | .04                | .258     | .02            | .478     | <b>.13</b>  | .001     | <b>.29</b>      | <.001    | <b>.49</b>           | <.001    | <b>.12</b>       | .003     |
| $\rho 3$                                   | .01         | .682     | .06                | .060     | .03            | .328     | .02         | .603     | <b>.34</b>      | <.001    | <b>.42</b>           | <.001    | .08              | .062     |
| $\rho 4$                                   | .06         | .070     | .06                | .092     | <b>.10</b>     | .003     | .04         | .328     | <b>.29</b>      | <.001    | <b>.33</b>           | <.001    | .09              | .026     |
| <i>Model fit</i>                           |             |          |                    |          |                |          |             |          |                 |          |                      |          |                  |          |
| $\chi^2$                                   | 2554.46     |          | 2717.19            |          | 2907.12        |          | 3134.25     |          | 4566.00         |          | 3996.93              |          | 3907.93          |          |
| df   | 908         |          | 908                |          | 908            |          | 1280        |          | 2230            |          | 1714                 |          | 1960             |          |
| CFI  | .92         |          | .90                |          | .90            |          | .92         |          | .95             |          | .92                  |          | .93              |          |
| RMSEA                                      | .03         |          | .03                |          | .03            |          | .03         |          | .02             |          | .02                  |          | .02              |          |
| SRMR                                       | .05         |          | .05                |          | .05            |          | .05         |          | .05             |          | .05                  |          | .04              |          |

*Note.* AT = Achievement Test. GPA = Grade Point Average. GPA was recoded so that higher numbers indicate better performance. All personality and well-being models contained an acquiescence factor.  $\alpha 1$ -3 show the 1-year stability effects of personality across the four measurement points,  $\beta 1$ -3 show the 1-year stability effects of the school-related experiences,  $\gamma 1$ -3 represent the cross-lagged effects from personality to the school-related experiences 1 year later,  $\delta 1$ -3 represent the cross-lagged effects of the school-related experiences on personality 1 year later,  $\rho 1$  represents the initial correlation between the personality trait and the school-related experiences,  $\rho 2$ -4 represent the correlated residuals at each measurement point. Indices a-d show whether the effects were set equal. All effects were controlled for gender, immigration status, school type, socioeconomic status, and cognitive abilities. Bold values show significant effects at a level of  $p < .01$ .

### ***Personality and Social Relationships***

**Personality Effects.** In line with our hypothesis, there were effects from all personality traits on subsequent school-related social relationships. Students with lower levels of neuroticism as well as those with higher extraversion, openness, agreeableness, and conscientiousness reported better friendship relationships at the following measurement point. For agreeableness, we again found a time-specific effect, but it was in the opposite direction of the achievement effect: With respect to social relationships, agreeableness tended to become more important as students got older, as it was only a statistically significant predictor from sixth to seventh and from seventh to eighth grade. Whereas all traits predicted subsequent friendship relationships, only students with lower levels of neuroticism and higher levels of agreeableness and conscientiousness reported higher teacher support at subsequent time points. These results were only partly in line with our hypotheses as we expected an additional effect of extraversion but no effect of conscientiousness.

**Social Relationship Effects.** In accordance with our hypotheses, students who had more positive friendships reported lower levels of neuroticism and higher levels of extraversion 1 year later. However, against our expectations, more teacher support was not related to subsequent adolescent personality.

### ***Personality and Well-Being***

**Personality Effects.** Again, our results showed that all personality traits were related to subsequent levels of at least one well-being indicator. Regarding well-being in school, only the more conscientious students reported higher well-being in school later on, whereas all personality traits predicted subsequent school belonging 1 year later. The statistically significant associations we found were in line with our hypothesis, although we expected additional effects of neuroticism and extraversion on well-being in school.

**Well-Being Effects.** In accordance with our hypotheses, students who reported higher well-being in school also reported lower levels of neuroticism, higher levels of extraversion, and, unexpectedly, higher levels of agreeableness and conscientiousness in subsequent years. School belonging showed the anticipated positive effect on subsequent extraversion but not the one hypothesized for neuroticism.

Taken together, overall, our results highlight the interrelatedness between personality and school experiences across time. Supporting previous findings, the models revealed more cross-lagged effects of personality on school experiences than vice versa. At the same time,

contrary to our hypotheses, we found cross-lagged effects of well-being in school on personality in adolescence for both agreeableness and conscientiousness.

### **Discussion**

In the present study, we investigated whether personality and a broad range of school-related experiences co-develop and show 1-year cross-effects across a time span of 3 years in adolescence. We did so by analyzing a large longitudinal sample of over 3,000 students in an understudied age group (11- to 14-year-olds) by including all Big Five personality traits and seven school-related experiences from three important domains and by using two different longitudinal approaches. Our results pointed to four main findings: First, students' personalities changed in accordance with their experiences in school, marking school as a very important developmental context in adolescence. Second, in line with previous research, personality turned out to be a stronger predictor of school experiences than vice versa. Third, although each personality trait was related to at least one subsequent school experience, the effects varied with respect to the personality trait and the school experience domain and were somewhat time-specific. Interestingly, conscientiousness was the only trait that stood out as a consistent predictor across time and domains. Fourth, a more differentiated pattern also emerged when school experiences predicted subsequent levels of personality, again, with one exception: Well-being in school was consistently associated with all personality traits 1 year later apart from openness. In the following, we first discuss the findings for the LGCM with respect to co-development between personality and school experiences, and second, we interpret the findings of the CLPM regarding reciprocal effects between personality and school experiences over time. We highlight the importance of our results for the personality and educational research fields, including implications for future research.

#### **Co-Development of Personality and School Experiences**

In line with previous research showing that adolescence is a developmentally sensitive phase with respect to personality (e.g., Borghuis et al., 2017; Denissen et al., 2013; Roberts & DelVecchio, 2000) and the manifold experiences students have at school (e.g., Eccles & Roeser, 2011; Engels et al., 2016; Wang & Eccles, 2012), we found that, except for neuroticism, participants' personality and school-related experiences changed substantially from fifth to eighth grade. Two main patterns regarding correlated change were especially interesting. First, the most differentiated pattern emerged within the domain of achievement:

On the one hand, our study supported previous findings by showing that change in GPA was associated with change in conscientiousness (e.g., Spengler et al., 2016) and that differences emerged between German and mathematics achievement (Brandt, Lechner, et al., 2019). On the other hand, our results extended previous research by indicating that, in contrast to German, mathematics appeared to be more closely intertwined with personality change: Mathematics achievement test scores changed in accordance with all personality traits, except for extraversion. By contrast, change in German achievement test scores was unrelated to all traits, except for an unpredicted association with agreeableness. The demands in mathematics are usually perceived as higher compared with general language competencies in the domain of German (Haag & Götz, 2012; Riding et al., 2003), and math tends to evoke more negative emotions in students (Götz et al., 2007; Sparfeldt et al., 2016). These negative emotions could lead to more lasting experiences that have a greater impact on personality. Thus, students who develop an emotionally stable, open-minded, calm, and conscientious personality might also be better able to meet the challenging demands that occur in math and show a positive change in mathematics achievement.

Second, besides the longitudinal interplay between personality and achievement, we also found that change in school-related social relationships and well-being were equally longitudinally associated with change in all Big Five personality traits from early to middle adolescence. In line with theoretical assumptions, school provides diverse developmental tasks in different school-related domains (Deci & Ryan, 2000; Havighurst, 1956) that we were able to connect to personality trait change. As school is the central setting for adolescents' development with respect to achievement and socioemotional learning (Eccles & Roeser, 2009), the successful mastering of the demands that students face in school includes not only good academic achievements but also the development of social skills and the ability to lay the foundation for a healthy life (Roeser et al., 2000; Zins & Elias, 2007). Our results emphasize the need to consider school as a holistic system in order to understand a student's (personality) development.

The clear longitudinal interrelatedness highlights the importance of investigating school as a complex and decisive context for adolescents' development. It also acknowledges adolescence as a central phase of development in many ways. Finally, it supports the crucial role of adolescents' personality for a broad range of important school outcomes. As all these developmental aspects are longitudinally interrelated and many entry points exist, future research could focus on developing interventions to support positive school experiences.

### **Personality as a Resource for Positive School Experiences**

Our results that were based on the CLPM emphasize the importance of personality for subsequent school outcomes from early to middle adolescence. Supporting previous findings on the power of personality for diverse life outcomes, our longitudinal findings show, for example, that openness and conscientiousness were consistently relevant for subsequent GPA (e.g., Spengler et al., 2016), that extraverted students tend to report more positive peer relationships as well as more school belonging later on (Evans et al., 2018; Wagner et al., 2014), and that agreeableness is a central personality trait for well-functioning relationships throughout school (Jensen-Campbell et al., 2003; Zee et al., 2013).

In adolescence, conscientiousness and neuroticism were the most consistent predictors of school experiences from fifth to eighth grade. Conscientiousness emerged as a general resource: Conscientious students reported consistently better achievement (except for mathematics competence), more positive and supportive relationships with peers and teachers, as well as higher well-being in school. Conscientious students can be described as task- and goal-oriented, planful, responsible, and hard-working, and they follow norms and rules (John & Srivastava, 1999). These characteristics are apparently the ones students need to succeed in the current school system with respect to these three domains (Dumfart & Neubauer, 2016; Evans et al., 2018; Jensen-Campbell & Malcolm, 2007).

As much as conscientiousness is a resource, high levels of neuroticism seem to have a vulnerability effect for adolescents in school. Thus, with characteristics that imply (test) anxiety, anger, irritation, and insecurity (John & Srivastava, 1999), these students will be less successful at taking exams (Buchwald, 2010; Chamorro-Premuzic et al., 2008), in experiencing positive peer and teacher interactions (Jensen-Campbell & Malcolm, 2007), and in feeling comfortable in school (Murberg & Bru, 2007). Interestingly, during middle adolescence, conscientiousness generally declines and neuroticism increases (Borghuis et al., 2017). Although we did not observe an increase in neuroticism in our sample, such disruptive developmental trends might also be related to the often-experienced drop in achievement, decreases in teacher support, and declines in well-being (Bru et al., 2010; Coelho et al., 2020; Wang & Eccles, 2012). If conscientiousness and neuroticism develop in ways that go against what is needed, adolescents will lack important resources in a time of increasing school-related challenges. Thus, if schools are committed to promoting socioemotional learning and personality development (Eccles & Roeser, 2011; Weissberg et al., 2015), they should focus more on supporting the development of conscientious and emotionally stable thoughts,

feelings, and behaviors, such as a constructive approach to homework (Göllner, Damian, et al., 2017). To address this lack of resources in another way, future research should also concentrate on when high neuroticism and low conscientiousness might be beneficial or when one trait might buffer or increase the effect of the other (Rosander & Bäckström, 2014).

Although personality resources for positive school experiences tend to be time-unspecific from early to middle adolescence in general, we found two interesting exceptions in the domain of achievement and social relationships: On the one hand, neuroticism, extraversion, and agreeableness showed more age-differentiated effects on academic achievement, operationalized as GPA, as these traits became less important when students got older. This finding is in stark contrast to the findings for openness and conscientiousness, which were consistently related to subsequent GPA across the entire time span. Thus, in early adolescence, all traits were still beneficial for grades, whereas in middle and late adolescence, only students with a conscientious and open personality reported better achievement (Andersen et al., 2020; Poropat, 2009; Tetzner et al., 2019). On the other hand, whereas agreeableness became less strongly associated with the GPA, it gained importance for having positive relationships with friends from early to middle adolescence. This supports findings from late adolescence and young adulthood when agreeableness is crucial for maintaining relationships (Harris & Vazire, 2016). Across adolescence, stable and supportive relationships with friends become increasingly important (Selfhout et al., 2008) with agreeableness playing a decisive role (Jensen-Campbell, & Malcolm, 2007).

In short, the personality of adolescents is related to subsequent school experiences, with conscientiousness being the most powerful resource and neuroticism a consistent vulnerability factor. The role of agreeableness is age-differential, changing from early to middle adolescence. These results emphasize the crucial role of personality as a resource for positive school experiences.

### **Positive School Experiences as a Resource for Personality Development**

All three domains of school experiences showed effects on subsequent personality in at least one of the five traits, although the effect sizes were small. Thus, our study extends the scarce literature investigating longitudinal effects of school experiences on personality (Brandt, Mike, et al., 2019; Israel et al., 2019; Tackman et al., 2017). We next discuss the three findings that stood out most.

Extraversion was the personality trait that was most consistently predicted by previous school experiences. Reports of positive friendships, well-being in school, and school belonging

were subsequently related to higher extraversion. As extraversion is characterized by being talkative, cheerful, gregarious, and energetic (Costa & McCrae, 1995), social experiences in school promote these characteristics. Interestingly, in addition to substantial correlated change effects, extraversion illustrated reciprocal lagged effects with both positive friendship relationships and school belonging emphasizing the interrelatedness of developmental trajectories from early to middle adolescence.

Furthermore, GPA and German achievement test scores showed positive associations with subsequent openness. Students who reported better grades and achievement results consistently predicted higher openness ratings later on (but also vice versa). High test scores and experiences of competency might motivate students to approach new tasks and topics and thus, to foster imagination, preferences for variety, and complex problems (Steinmayr & Spinath, 2009). Unexpectedly, we found no effects of achievement on conscientiousness. One explanation could be found in our sample composition, which did not include any schools from the mostly demanding academic track. Particularly in academic tracks, however, conscientiousness and academic achievement showed stronger associations than in intermediate or vocational track schools (Brandt, Lechner et al., 2019). Another explanation lay in the school curriculum, which mostly included substantive knowledge and, to a lesser extent, structured working methods that might be more strongly related to conscientiousness over time (Komarraju et al., 2011).

Well-being in school was most decisive for personality development. Enjoying school lays a foundation for positive personality development during adolescence as students who reported higher well-being also reported lower levels of neuroticism as well as higher extraversion, agreeableness, and conscientiousness at subsequent measurement points. Thus, when students experience a sense of well-being in school, they have enough resources to meet new demands (Denissen et al., 2013) that, in the long run, also result in personality change. This supports recent research on the importance of well-being for adolescents' development in school (Lampropoulou, 2018) and emphasizes the need for interventions to foster well-being in school (Bleidorn et al., 2019; Gorard & See, 2011; Hatzichristou et al., 2014).

In sum, adolescents' school experiences within all three domains of achievement, social relationships, and well-being were found to be related to subsequent personality change from fifth to eighth grade, such that extraversion was the most responsive to school experiences, openness showed reciprocal effects with achievement, and well-being in school was related to all personality traits except for openness across time.

## **Limitations and Outlook**

Despite the strengths of having a longitudinal data set that included all the Big Five personality traits and diverse school experiences in a large sample of adolescents across 3 years, we also have to acknowledge some limitations of our study.

First, even with a longitudinal design, our study did not allow us to conduct a controlled manipulation of personality or school experiences. Although we included many different school experiences and controlled for important covariates, we were unable to map the complex school system in its entirety. Thus, we were unable to draw any causal conclusions because potential further factors of influence might be missing, such as person-classroom interactions (Lau & Nie, 2008) or broader aspects of personality such as self-esteem and motivation (Skinner et al., 2008; Wagner et al., 2018). Moreover, school is one important context for adolescents' development, but it is probably not the only one as family still plays a crucial role (e.g., Syed & Seiffge-Krenke, 2013).

Second, except for test scores, all the remaining variables were self-reported. This bore the risk of shared rater variance (Podsakoff et al., 2003). At the same time, adolescents' own subjective perceptions might be more relevant for their own development, especially for variables such as well-being. Moreover, statistically significant associations with the two objective achievement tests showed similar effect sizes in parent reports, encouraging us to assume that the longitudinal design and the use of latent variable models supported our conclusions.

Finally, our aim was to get a sound picture of the longitudinal interplay of personality and different school experiences, including indicators from three important domains of school experiences such as achievement, social relationships, and well-being. This led to a large number of analyses, which comes with a higher risk of rejecting null hypotheses by chance. To reduce this risk, we discussed only associations that were statistically significant at  $p < .01$  and reported the exact  $p$ -value. Nevertheless, when controlling for prior stability, effects over time are often small (especially from school experiences on personality), and their meaning should be evaluated with caution. We would like to highlight, however, that our effect sizes as well as the associations we found are comparable to those from previous studies in this area (e.g., Spengler et al., 2016) and to personality research in general (Funder & Ozer, 2019). Future studies are needed to replicate the results to further support our conclusions about the interrelatedness of personality development and change in school experiences in adolescence.



**Conclusion**

Personality traits and school experiences are longitudinally intertwined across the developmentally sensitive phase that runs from early to middle adolescence. School emerged as a promising environment in which to better understand the importance of personality as a resource for positive school experiences but also to unravel why and when adolescents' personalities develop. Future research should become increasingly more integrative in its consideration of school as a developmental environment by including not only achievement and socioemotional variables but also personality characteristics as an important factor that pushes development but can also be developed by school-related experiences. Furthermore, future research could also focus on the development of interventions targeted toward positive developments in personality to lay the foundation for positive developmental trajectories across the entire life span.

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### **Footnotes**

<sup>1</sup> The use of the CFI as a pointwise estimate of model fit was criticized in recent research, as it was found to be strongly dependent on the magnitude of item loadings (Moshagen & Auerswald, 2018). Therefore, we evaluated model fit by considering three different indicators (CFI, RMSEA, SRMR). Given the acceptable fit of the model with respect to the remaining fit indices, we are confident in the model results.



## Appendix Study 3

Table OS1

*Manifest Bivariate Correlations of Students' Personality and all School Experiences at T1*

|                               |                           | 1           | 2          | 3          | 4           | 5          | 6           | 7           | 8           | 9           | 10          | 11          | 12         | 13   | 14          | 15          | 16         |
|-------------------------------|---------------------------|-------------|------------|------------|-------------|------------|-------------|-------------|-------------|-------------|-------------|-------------|------------|------|-------------|-------------|------------|
| Personality students' ratings | (1) Neuroticism           |             |            |            |             |            |             |             |             |             |             |             |            |      |             |             |            |
|                               | (2) Extraversion          | <b>-.21</b> |            |            |             |            |             |             |             |             |             |             |            |      |             |             |            |
|                               | (3) Openness              | <b>-.11</b> | <b>.38</b> |            |             |            |             |             |             |             |             |             |            |      |             |             |            |
|                               | (4) Agreeableness         | <b>-.30</b> | <b>.18</b> | <b>.28</b> |             |            |             |             |             |             |             |             |            |      |             |             |            |
|                               | (5) Conscientiousness     | <b>-.35</b> | <b>.32</b> | <b>.37</b> | <b>.44</b>  |            |             |             |             |             |             |             |            |      |             |             |            |
| Achievement                   | (6) GPA                   | <b>-.18</b> | <b>.09</b> | .02        | <b>.13</b>  | <b>.14</b> |             |             |             |             |             |             |            |      |             |             |            |
|                               | (7) German language AT    | <b>-.23</b> | <b>.16</b> | <b>.11</b> | <b>.27</b>  | <b>.12</b> | <b>.37</b>  |             |             |             |             |             |            |      |             |             |            |
|                               | (8) Mathematics AT        | <b>-.18</b> | <b>.11</b> | .05        | <b>.09</b>  | <b>.07</b> | <b>.40</b>  | <b>.53</b>  |             |             |             |             |            |      |             |             |            |
| Social relationships          | (9) Friends               | <b>-.08</b> | <b>.22</b> | <b>.13</b> | <b>.09</b>  | <b>.16</b> | -.03        | <b>-.10</b> | -.03        |             |             |             |            |      |             |             |            |
|                               | (10) Teacher support      | <b>-.07</b> | <b>.18</b> | <b>.24</b> | <b>.17</b>  | <b>.27</b> | .01         | -.01        | <b>-.09</b> | <b>.13</b>  |             |             |            |      |             |             |            |
| Well-being                    | (11) Well-being in school | <b>-.14</b> | <b>.15</b> | <b>.26</b> | <b>.26</b>  | <b>.36</b> | .03         | -.05        | <b>-.09</b> | <b>.13</b>  | <b>.29</b>  |             |            |      |             |             |            |
|                               | (12) School belonging     | <b>-.22</b> | <b>.26</b> | <b>.12</b> | <b>.16</b>  | <b>.22</b> | <b>.10</b>  | <b>.09</b>  | <b>.11</b>  | <b>.33</b>  | <b>.15</b>  | <b>.18</b>  |            |      |             |             |            |
| Covariates                    | (13) Gender               | -.04        | .02        | <b>.08</b> | <b>.27</b>  | <b>.12</b> | .03         | <b>.06</b>  | <b>-.19</b> | -.04        | <b>.09</b>  | <b>.19</b>  | .01        |      |             |             |            |
|                               | (14) School type          | <b>-.17</b> | <b>.10</b> | -.03       | <b>.12</b>  | .04        | <b>.39</b>  | <b>.39</b>  | <b>.45</b>  | <b>-.07</b> | <b>-.07</b> | <b>-.10</b> | <b>.13</b> | .01  |             |             |            |
|                               | (15) Immigration status   | <b>.13</b>  | .00        | .06        | <b>-.08</b> | .01        | <b>-.23</b> | <b>-.30</b> | <b>-.27</b> | .02         | <b>.09</b>  | <b>.12</b>  | -.05       | .00  | <b>-.42</b> |             |            |
|                               | (16) SES                  | -.04        | .05        | .03        | <b>.08</b>  | -.01       | <b>.13</b>  | <b>.16</b>  | <b>.15</b>  | .00         | -.05        | -.04        | .06        | -.02 | <b>.16</b>  | <b>-.22</b> |            |
|                               | (17) Cognitive abilities  | <b>-.10</b> | <b>.07</b> | .04        | <b>.12</b>  | .04        | <b>.22</b>  | <b>.37</b>  | <b>.43</b>  | -.04        | -.05        | -.01        | .01        | .04  | <b>.23</b>  | <b>-.12</b> | <b>.08</b> |

Note. AT = Achievement Test. GPA = Grade Point Average. The GPA is recoded so that higher numbers indicate better performance. The variables gender (1 = female), school type (1 = intermediate or multitrack schools), and immigration status (1 = yes) were dummy-coded. Bold values are significant at  $p < .01$ .

**Table OS2***Fit Indices for Measurement Invariances Tests for the Big Five Personality Factors and School-Related Variables*

| Model                        | $\chi^2$   | df  | CFI  | RMSEA | SRMR |
|------------------------------|------------|-----|------|-------|------|
| Neuroticism                  |            |     |      |       |      |
| Model 1: Unconstrained model | 801.009**  | 400 | .966 | .017  | .028 |
| Model 2: Weak invariance     | 856.410**  | 421 | .963 | .017  | .030 |
| Model 3: Strong invariance   | 947.356**  | 442 | .957 | .018  | .031 |
| Extraversion                 |            |     |      |       |      |
| Model 1: Unconstrained model | 986.025**  | 400 | .963 | .021  | .036 |
| Model 2: Weak invariance     | 1047.591** | 421 | .960 | .021  | .038 |
| Model 3: Strong invariance   | 1251.335** | 442 | .948 | .023  | .039 |
| Openness                     |            |     |      |       |      |
| Model 1: Unconstrained model | 2478.968** | 820 | .930 | .024  | .036 |
| Model 2: Weak invariance     | 2533.682** | 850 | .929 | .024  | .038 |
| Model 3: Strong invariance   | 2642.519** | 880 | .926 | .024  | .038 |
| Agreeableness                |            |     |      |       |      |
| Model 1: Unconstrained model | 826.251**  | 400 | .967 | .018  | .029 |
| Model 2: Weak invariance     | 874.327**  | 421 | .965 | .018  | .031 |
| Model 3: Strong invariance   | 1048.238** | 442 | .953 | .020  | .033 |
| Conscientiousness            |            |     |      |       |      |
| Model 1: Unconstrained model | 1190.385** | 524 | .962 | .019  | .031 |
| Model 2: Weak invariance     | 1271.722** | 548 | .959 | .020  | .034 |
| Model 3: Strong invariance   | 1398.368** | 572 | .953 | .020  | .035 |
| Friends                      |            |     |      |       |      |
| Model 1: Unconstrained model | 54.669**   | 30  | .996 | .016  | .021 |
| Model 2: Weak invariance     | 60.838**   | 36  | .996 | .014  | .024 |
| Model 3: Strong invariance   | 181.009**  | 42  | .980 | .031  | .034 |
| Teacher support              |            |     |      |       |      |
| Model 1: Unconstrained model | 877.393**  | 302 | .982 | .023  | .018 |
| Model 2: Weak invariance     | 918.795**  | 320 | .981 | .023  | .022 |
| Model 3: Strong invariance   | 1004.235** | 338 | .979 | .024  | .025 |
| Well-being at school         |            |     |      |       |      |
| Model 1: Unconstrained model | 438.193**  | 124 | .974 | .027  | .031 |
| Model 2: Weak invariance     | 471.550**  | 136 | .972 | .027  | .034 |
| Model 3: Strong invariance   | 573.554**  | 148 | .965 | .029  | .034 |
| School belonging             |            |     |      |       |      |
| Model 1: Unconstrained model | 344.551**  | 200 | .989 | .015  | .027 |
| Model 2: Weak invariance     | 375.272**  | 215 | .988 | .015  | .030 |
| Model 3: Strong invariance   | 675.577**  | 230 | .967 | .024  | .035 |

*Note.* Models of neuroticism, extraversion, openness, agreeableness, conscientiousness, school belonging, and well-being at school contain an acquiescence factor. \*\*  $p < .01$

**Table OS3**

*Bivariate Latent Growth Curve Models for Each Big Five Personality Factor Combined with Each School Experience*

|                             |  | Neuroticism |               | Extraversion |             | Openness   |             | Agreeableness |             | Conscientiousness |             |
|-----------------------------|--|-------------|---------------|--------------|-------------|------------|-------------|---------------|-------------|-------------------|-------------|
|                             |  | <i>r</i>    | 99% CI        | <i>r</i>     | 99% CI      | <i>r</i>   | 99% CI      | <i>r</i>      | 99% CI      | <i>r</i>          | 99% CI      |
| <i>Achievement</i>          |  |             |               |              |             |            |             |               |             |                   |             |
| GPA                         | I <sub>Personality</sub> × I <sub>GPA</sub>                  | <b>-.24</b> | [-.34; -.14]  | <b>.14</b>   | [.04; .24]  | <b>.12</b> | [.01; .22]  | <b>.25</b>    | [.15; .35]  | <b>.34</b>        | [.25; .43]  |
|                             | S <sub>Personality</sub> × S <sub>GPA</sub>                  | -.18        | [-.38; .03]   | .06          | [-.12; .24] | .10        | [-.12; .32] | .16           | [-.03; .35] | <b>.34</b>        | [.16; .51]  |
| German language AT          | I <sub>Personality</sub> × I <sub>German AT</sub>            | <b>-.32</b> | [-.43; -.21]  | <b>.29</b>   | [.20; .39]  | <b>.37</b> | [.26; .47]  | <b>.49</b>    | [.38; .60]  | <b>.24</b>        | [.14; .33]  |
|                             | S <sub>Personality</sub> × S <sub>German AT</sub>            | -.26        | [-.54; .02]   | .18          | [-.05; .41] | .04        | [-.24; .32] | <b>.26</b>    | [.01; .52]  | .14               | [-.08; .35] |
| Mathematics AT              | I <sub>Personality</sub> × I <sub>Mathematics AT</sub>       | <b>-.24</b> | [-.34; -.13]  | <b>.19</b>   | [.10; .28]  | <b>.22</b> | [.12; .33]  | <b>.17</b>    | [.07; .27]  | <b>.17</b>        | [.07; .26]  |
|                             | S <sub>Personality</sub> × S <sub>Mathematics AT</sub>       | <b>-.44</b> | [-.73; -.15]  | .18          | [-.05; .41] | <b>.31</b> | [.05; .58]  | <b>.31</b>    | [.06; .57]  | <b>.35</b>        | [.14; .57]  |
| <i>Social relationships</i> |  |             |               |              |             |            |             |               |             |                   |             |
| Friendship                  | I <sub>Personality</sub> × I <sub>Friendship</sub>           | <b>-.58</b> | [-.76; -.41]  | <b>.63</b>   | [.48; .76]  | <b>.52</b> | [.34; .69]  | <b>.41</b>    | [.24; .57]  | <b>.49</b>        | [.34; .63]  |
|                             | S <sub>Personality</sub> × S <sub>Friendship</sub>           | <b>-.75</b> | [-1.28; -.22] | <b>.90</b>   | [.33; 1.47] | <b>.77</b> | [.17; 1.37] | .34           | [-.03; .71] | <b>.44</b>        | [.07; .80]  |
| Teacher support             | I <sub>Personality</sub> × I <sub>Teacher support</sub>      | <b>-.30</b> | [-.42; -.19]  | <b>.25</b>   | [.14; .35]  | <b>.47</b> | [.33; .60]  | <b>.40</b>    | [.28; .52]  | <b>.54</b>        | [.43; .64]  |
|                             | S <sub>Personality</sub> × S <sub>Teacher support</sub>      | <b>-.35</b> | [-.54; -.16]  | <b>.33</b>   | [.17; .50]  | <b>.74</b> | [.48; 1.01] | <b>.48</b>    | [.29; .67]  | <b>.68</b>        | [.49; .87]  |
| <i>Well-being</i>           |  |             |               |              |             |            |             |               |             |                   |             |
| Well-being in school        | I <sub>Personality</sub> × I <sub>Well-being in school</sub> | <b>-.50</b> | [-.61; -.38]  | <b>.27</b>   | [.16; .37]  | <b>.59</b> | [.47; .71]  | <b>.58</b>    | [.47; .69]  | <b>.81</b>        | [.71; .90]  |
|                             | S <sub>Personality</sub> × S <sub>Well-being in school</sub> | <b>-.40</b> | [-.62; -.18]  | <b>.20</b>   | [.03; .38]  | <b>.77</b> | [.47; 1.07] | <b>.50</b>    | [.29; .72]  | <b>.84</b>        | [.63; 1.05] |
| School belonging            | I <sub>Personality</sub> × I <sub>School belonging</sub>     | <b>-.61</b> | [-.73; -.49]  | <b>.53</b>   | [.42; .63]  | <b>.28</b> | [.15; .41]  | <b>.40</b>    | [.28; .52]  | <b>.43</b>        | [.33; .53]  |
|                             | S <sub>Personality</sub> × S <sub>School belonging</sub>     | <b>-.63</b> | [-.91; -.36]  | <b>.69</b>   | [.46; .92]  | <b>.29</b> | [.04; .53]  | <b>.21</b>    | [.01; .41]  | <b>.26</b>        | [.07; .44]  |
| <i>Model fit range</i>      |  |             |               |              |             |            |             |               |             |                   |             |
| CFI                         |  | .91-.95     |               | .91-.94      |             | .89-.93    |             | .92-.95       |             | .91-.95           |             |
| RMSEA                       |  | .02-.03     |               | .02-.03      |             | .02-.03    |             | .02-.03       |             | .02               |             |
| SRMR                        |  | .04-.05     |               | .04-.06      |             | .05        |             | .04-.05       |             | .04-.05           |             |

*Note.* AT = Achievement Test, GPA = Grade Point Average, I = Intercept, S = Slope. GPA was recoded so that higher numbers indicate better performance. All personality and well-being models contained an acquiescence factor. All models were controlled for gender, immigration status, school type, SES, and cognitive abilities. Bold values were statistically significant at  $p < .01$ .

Table OS4

Standardized Parameter Estimates of the CLPM of Neuroticism and School Experiences

|                             | GPA         |              | German language AT |              | Mathematics AT |              | Friends      |              | Teacher support |              | Well-being in school |              | School belonging |              |
|-----------------------------|-------------|--------------|--------------------|--------------|----------------|--------------|--------------|--------------|-----------------|--------------|----------------------|--------------|------------------|--------------|
|                             | Est         | 99% CI       | Est                | 99% CI       | Est            | 99% CI       | Est          | 99% CI       | Est             | 99% CI       | Est                  | 99% CI       | Est              | 99% CI       |
| <i>Stability effects</i>    |             |              |                    |              |                |              |              |              |                 |              |                      |              |                  |              |
| $\alpha 1$                  | <b>.62a</b> | [.55; .69]   | <b>.62a</b>        | [.55; .69]   | <b>.62a</b>    | [.55; .69]   | <b>.62a</b>  | [.55; .68]   | <b>.62a</b>     | [.55; .68]   | <b>.61a</b>          | [.54; .68]   | <b>.62a</b>      | [.55; .70]   |
| $\alpha 2$                  | <b>.72a</b> | [.65; .79]   | <b>.71a</b>        | [.64; .78]   | <b>.71a</b>    | [.64; .78]   | <b>.70a</b>  | [.63; .77]   | <b>.71a</b>     | [.64; .78]   | <b>.70a</b>          | [.63; .77]   | <b>.71a</b>      | [.63; .78]   |
| $\alpha 3$                  | <b>.68a</b> | [.62; .74]   | <b>.67a</b>        | [.61; .73]   | <b>.68a</b>    | [.62; .74]   | <b>.67a</b>  | [.60; .73]   | <b>.67a</b>     | [.61; .73]   | <b>.67a</b>          | [.61; .73]   | <b>.68a</b>      | [.61; .74]   |
| $\beta 1$                   | <b>.56</b>  | [.52; .61]   | <b>.61</b>         | [.58; .65]   | <b>.66</b>     | [.63; .69]   | <b>.38b</b>  | [.31; .46]   | <b>.47</b>      | [.40; .53]   | <b>.64b</b>          | [.60; .69]   | <b>.54b</b>      | [.48; .61]   |
| $\beta 2$                   | <b>.75</b>  | [.72; .78]   | <b>.61</b>         | [.57; .64]   | <b>.63</b>     | [.60; .67]   | <b>.43b</b>  | [.34; .51]   | <b>.39</b>      | [.32; .46]   | <b>.69b</b>          | [.64; .74]   | <b>.63b</b>      | [.56; .70]   |
| $\beta 3$                   | <b>.71</b>  | [.68; .75]   | <b>.56</b>         | [.51; .60]   | <b>.63</b>     | [.59; .67]   | <b>.40b</b>  | [.32; .48]   | <b>.42</b>      | [.35; .49]   | <b>.69b</b>          | [.64; .74]   | <b>.57b</b>      | [.50; .63]   |
| <i>Cross-lagged effects</i> |             |              |                    |              |                |              |              |              |                 |              |                      |              |                  |              |
| $\gamma 1$                  | <b>-.20</b> | [-.29; -.12] | <b>-.08b</b>       | [-.12; -.04] | <b>-.04b</b>   | [-.08; -.01] | <b>-.10c</b> | [-.15; -.05] | <b>-.06b</b>    | [-.10; -.02] | -.01c                | [-.05; .03]  | <b>-.08c</b>     | [-.13; -.04] |
| $\gamma 2$                  | -.01        | [-.06; .04]  | <b>-.09b</b>       | [-.13; -.04] | <b>-.05b</b>   | [-.09; -.01] | <b>-.12c</b> | [-.18; -.06] | <b>-.07b</b>    | [-.12; -.03] | -.02c                | [-.06; .03]  | <b>-.10c</b>     | [-.15; -.05] |
| $\gamma 3$                  | -.05        | [-.11; .00]  | <b>-.07b</b>       | [-.10; -.03] | <b>-.04b</b>   | [-.08; -.01] | <b>-.12c</b> | [-.18; -.06] | <b>-.07b</b>    | [-.11; -.03] | -.02c                | [-.07; .03]  | <b>-.10c</b>     | [-.15; -.05] |
| $\delta 1$                  | -.00b       | [-.05; .04]  | -.03c              | [-.06; .01]  | -.02c          | [-.06; .01]  | <b>-.05d</b> | [-.10; -.00] | -.03c           | [-.07; .01]  | <b>-.05d</b>         | [-.10; -.01] | -.02d            | [-.07; .03]  |
| $\delta 2$                  | -.00b       | [-.04; .03]  | -.03c              | [-.07; .01]  | -.02c          | [-.06; .01]  | <b>-.05d</b> | [-.10; -.00] | -.04c           | [-.08; .01]  | <b>-.05d</b>         | [-.10; -.01] | -.02d            | [-.07; .03]  |
| $\delta 3$                  | -.00b       | [-.03; .03]  | -.03c              | [-.07; .01]  | -.02c          | [-.06; .01]  | <b>-.05d</b> | [-.09; -.00] | -.04c           | [-.08; .01]  | <b>-.05d</b>         | [-.09; -.01] | -.02d            | [-.06; .03]  |
| <i>Correlated residuals</i> |             |              |                    |              |                |              |              |              |                 |              |                      |              |                  |              |
| $\rho 1$                    | <b>-.10</b> | [-.18; -.02] | <b>-.21</b>        | [-.28; -.13] | <b>-.14</b>    | [-.21; -.08] | <b>-.29</b>  | [-.38; -.20] | <b>-.22</b>     | [-.30; -.14] | <b>-.38</b>          | [-.46; -.30] | <b>-.43</b>      | [-.51; -.35] |
| $\rho 2$                    | -.02        | [-.12; .07]  | -.05               | [-.15; .04]  | -.01           | [-.10; .07]  | <b>-.29</b>  | [-.39; -.19] | <b>-.13</b>     | [-.24; -.03] | <b>-.32</b>          | [-.43; -.21] | <b>-.36</b>      | [-.46; -.25] |
| $\rho 3$                    | -.07        | [-.17; .03]  | -.08               | [-.18; .02]  | -.09           | [-.19; -.01] | <b>-.22</b>  | [-.34; -.11] | <b>-.23</b>     | [-.34; -.12] | <b>-.27</b>          | [-.40; -.14] | <b>-.27</b>      | [-.39; -.15] |
| $\rho 4$                    | .00         | [-.09; .09]  | -.01               | [-.11; .08]  | -.08           | [-.17; -.01] | <b>-.21</b>  | [-.31; -.11] | <b>-.17</b>     | [-.27; -.07] | <b>-.18</b>          | [-.30; -.05] | <b>-.27</b>      | [-.36; -.17] |
| <i>Model fit</i>            |             |              |                    |              |                |              |              |              |                 |              |                      |              |                  |              |
| $\chi^2$                    | 2003.16     |              | 2328.51            |              | 2383.01        |              | 2537.86      |              | 3998.72         |              | 3347.39              |              | 3553.73          |              |
| df                          | 740         |              | 742                |              | 742            |              | 1082         |              | 1968            |              | 1484                 |              | 1714             |              |
| CFI                         | .92         |              | .89                |              | .89            |              | .92          |              | .95             |              | .92                  |              | .93              |              |
| RMSEA                       | .03         |              | .03                |              | .03            |              | .02          |              | .02             |              | .02                  |              | .02              |              |
| SRMR                        | .05         |              | .05                |              | .05            |              | .05          |              | .05             |              | .05                  |              | .04              |              |

Note. CI = Confidence Interval. AT = Achievement Test. GPA = Grade Point Average. GPA was recoded so that higher numbers indicate better performance. All personality and well-being models contained an acquiescence factor.  $\alpha 1$ -3 show the 1-year stability effects of personality across the four measurement points,  $\beta 1$ -3 show the 1-year stability effects of the school-related experiences,  $\gamma 1$ -3 represent the cross-lagged effects from personality to the school-related experiences 1 year later,  $\delta 1$ -3 represent the cross-lagged effects of the school-related experiences on personality 1 year later,  $\rho 1$  represents the initial correlation between the personality trait and the school-related experiences,  $\rho 2$ -4 represent the correlated residuals at each measurement point. Indices a-d show whether the effects were set equal. All effects were controlled for gender, immigration status, school type, socioeconomic status, and cognitive abilities. Bold values show significant effects at a level of  $p < .01$ .

Table OS5

Standardized Parameter Estimates of the CLPM of Extraversion and School Experiences

|                             | GPA         |             | German language AT |             | Mathematics AT |             | Friends     |            | Teacher support |             | Well-being in school |             | School belonging |            |
|-----------------------------|-------------|-------------|--------------------|-------------|----------------|-------------|-------------|------------|-----------------|-------------|----------------------|-------------|------------------|------------|
|                             | Est         | 99% CI      | Est                | 99% CI      | Est            | 99% CI      | Est         | 99% CI     | Est             | 99% CI      | Est                  | 99% CI      | Est              | 99% CI     |
| <i>Stability effects</i>    |             |             |                    |             |                |             |             |            |                 |             |                      |             |                  |            |
| $\alpha 1$                  | <b>.68a</b> | [.62; .73]  | <b>.67a</b>        | [.61; .73]  | <b>.68a</b>    | [.62; .74]  | <b>.66a</b> | [.60; .72] | <b>.68a</b>     | [.62; .73]  | <b>.67a</b>          | [.61; .72]  | <b>.65a</b>      | [.59; .71] |
| $\alpha 2$                  | <b>.72a</b> | [.66; .77]  | <b>.71a</b>        | [.65; .77]  | <b>.72a</b>    | [.66; .77]  | <b>.70a</b> | [.64; .76] | <b>.72a</b>     | [.66; .77]  | <b>.70a</b>          | [.65; .76]  | <b>.70a</b>      | [.64; .76] |
| $\alpha 3$                  | <b>.71a</b> | [.66; .76]  | <b>.70a</b>        | [.65; .75]  | <b>.71a</b>    | [.66; .76]  | <b>.70a</b> | [.64; .75] | <b>.71a</b>     | [.66; .76]  | <b>.70a</b>          | [.65; .75]  | <b>.69a</b>      | [.63; .74] |
| $\beta 1$                   | <b>.59</b>  | [.55; .62]  | <b>.61</b>         | [.58; .65]  | <b>.66</b>     | [.63; .69]  | <b>.37b</b> | [.27; .44] | <b>.48</b>      | [.42; .54]  | <b>.64b</b>          | [.60; .69]  | <b>.53b</b>      | [.47; .60] |
| $\beta 2$                   | <b>.74</b>  | [.72; .77]  | <b>.61</b>         | [.57; .64]  | <b>.64</b>     | [.60; .67]  | <b>.41b</b> | [.32; .49] | <b>.40</b>      | [.33; .47]  | <b>.69b</b>          | [.65; .74]  | <b>.62b</b>      | [.55; .69] |
| $\beta 3$                   | <b>.72</b>  | [.69; .75]  | <b>.56</b>         | [.51; .60]  | <b>.63</b>     | [.59; .67]  | <b>.38b</b> | [.30; .46] | <b>.44</b>      | [.37; .52]  | <b>.69b</b>          | [.64; .74]  | <b>.55b</b>      | [.48; .61] |
| <i>Cross-lagged effects</i> |             |             |                    |             |                |             |             |            |                 |             |                      |             |                  |            |
| $\gamma 1$                  | <b>.12</b>  | [.05; .19]  | <b>.08b</b>        | [.04; .11]  | <b>.03b</b>    | [.00; .07]  | <b>.14c</b> | [.09; .18] | -.01b           | [-.05; .03] | .02c                 | [-.02; .05] | <b>.11c</b>      | [.07; .15] |
| $\gamma 2$                  | .03         | [-.02; .08] | <b>.08b</b>        | [.04; .12]  | <b>.04b</b>    | [.00; .07]  | <b>.16c</b> | [.11; .22] | -.01b           | [-.05; .04] | .02c                 | [-.02; .06] | <b>.13c</b>      | [.08; .18] |
| $\gamma 3$                  | .03         | [-.01; .08] | <b>.07b</b>        | [.04; .01]  | <b>.04b</b>    | [.00; .07]  | <b>.17c</b> | [.11; .23] | -.01b           | [-.05; .04] | .03c                 | [-.02; .07] | <b>.13c</b>      | [.08; .19] |
| $\delta 1$                  | -.00b       | [-.04; .04] | .02c               | [-.01; .06] | -.00c          | [-.04; .03] | <b>.05d</b> | [.01; .10] | .01c            | [-.03; .04] | <b>.07d</b>          | [.02; .11]  | <b>.06d</b>      | [.01; .10] |
| $\delta 2$                  | -.00b       | [-.03; .03] | .03c               | [-.01; .06] | -.00c          | [-.04; .03] | <b>.05d</b> | [.01; .10] | .01c            | [-.03; .05] | <b>.06d</b>          | [.02; .10]  | <b>.06d</b>      | [.01; .11] |
| $\delta 3$                  | -.00b       | [-.03; .03] | .03c               | [-.01; .06] | -.00c          | [-.03; .03] | <b>.05d</b> | [.01; .09] | .01c            | [-.03; .05] | <b>.05d</b>          | [.02; .09]  | <b>.05d</b>      | [.01; .09] |
| <i>Correlated residuals</i> |             |             |                    |             |                |             |             |            |                 |             |                      |             |                  |            |
| $\rho 1$                    | <b>.07</b>  | [.00; .14]  | <b>.20</b>         | [.14; .27]  | <b>.12</b>     | [.06; .19]  | <b>.33</b>  | [.25; .40] | <b>.18</b>      | [.10; .26]  | <b>.19</b>           | [.11; .28]  | <b>.37</b>       | [.30; .44] |
| $\rho 2$                    | .02         | [-.08; .11] | .09                | [-.00; .17] | -.08           | [-.17; .01] | <b>.31</b>  | [.21; .41] | <b>.16</b>      | [.06; .26]  | <b>.17</b>           | [.06; .29]  | <b>.28</b>       | [.17; .38] |
| $\rho 3$                    | .01         | [-.07; .09] | .03                | [-.06; .11] | .08            | [-.01; .17] | <b>.24</b>  | [.13; .35] | <b>.23</b>      | [.12; .34]  | <b>.15</b>           | [.03; .27]  | <b>.28</b>       | [.16; .39] |
| $\rho 4$                    | .00         | [-.08; .09] | .03                | [-.05; .11] | .04            | [-.05; .13] | <b>.25</b>  | [.16; .35] | <b>.12</b>      | [.02; .21]  | .08                  | [-.03; .19] | <b>.31</b>       | [.21; .40] |
| <i>Model fit</i>            |             |             |                    |             |                |             |             |            |                 |             |                      |             |                  |            |
| $\chi^2$                    | 2354.18     |             | 2491.80            |             | 2638.27        |             | 2882.75     |            | 4448.46         |             | 3788.80              |             | 3828.17          |            |
| df                          | 740         |             | 742                |             | 742            |             | 1082        |            | 1968            |             | 1484                 |             | 1714             |            |
| CFI                         | .91         |             | .90                |             | .90            |             | .91         |            | .94             |             | .91                  |             | .92              |            |
| RMSEA                       | .03         |             | .03                |             | .03            |             | .03         |            | .02             |             | .03                  |             | .02              |            |
| SRMR                        | .05         |             | .05                |             | .05            |             | .05         |            | .06             |             | .06                  |             | .05              |            |

Note. CI = Confidence Interval. AT = Achievement Test. GPA = Grade Point Average. GPA was recoded so that higher numbers indicate better performance. All personality and well-being models contained an acquiescence factor.  $\alpha 1$ -3 show the 1-year stability effects of personality across the four measurement points,  $\beta 1$ -3 show the 1-year stability effects of the school-related experiences,  $\gamma 1$ -3 represent the cross-lagged effects from personality to the school-related experiences 1 year later,  $\delta 1$ -3 represent the cross-lagged effects of the school-related experiences on personality 1 year later,  $\rho 1$  represents the initial correlation between the personality trait and the school-related experiences,  $\rho 2$ -4 represent the correlated residuals at each measurement point. Indices a-d show whether the effects were set equal. All effects were controlled for gender, immigration status, school type, socioeconomic status, and cognitive abilities. Bold values show significant effects at a level of  $p < .01$ .

Table OS6

Standardized Parameter Estimates of the CLPM of Openness and School Experiences

|                             | GPA         |             | German language AT |             | Mathematics AT |             | Friends     |             | Teacher support |             | Well-being in school |             | School belonging |             |
|-----------------------------|-------------|-------------|--------------------|-------------|----------------|-------------|-------------|-------------|-----------------|-------------|----------------------|-------------|------------------|-------------|
|                             | Est         | 99% CI      | Est                | 99% CI      | Est            | 99% CI      | Est         | 99% CI      | Est             | 99% CI      | Est                  | 99% CI      | Est              | 99% CI      |
| <i>Stability effects</i>    |             |             |                    |             |                |             |             |             |                 |             |                      |             |                  |             |
| $\alpha 1$                  | <b>.65a</b> | [.58; .72]  | <b>.65a</b>        | [.58; .72]  | <b>.65a</b>    | [.58; .73]  | <b>.65a</b> | [.58; .72]  | <b>.66a</b>     | [.59; .73]  | <b>.65a</b>          | [.58; .73]  | <b>.66a</b>      | [.59; .73]  |
| $\alpha 2$                  | <b>.71a</b> | [.64; .78]  | <b>.70a</b>        | [.63; .77]  | <b>.71a</b>    | [.64; .78]  | <b>.71a</b> | [.63; .78]  | <b>.72a</b>     | [.64; .79]  | <b>.71a</b>          | [.63; .79]  | <b>.72a</b>      | [.65; .79]  |
| $\alpha 3$                  | <b>.71a</b> | [.64; .78]  | <b>.70a</b>        | [.63; .77]  | <b>.71a</b>    | [.64; .78]  | <b>.71a</b> | [.64; .78]  | <b>.72a</b>     | [.65; .79]  | <b>.72a</b>          | [.64; .79]  | <b>.72a</b>      | [.65; .79]  |
| $\beta 1$                   | <b>.60</b>  | [.56; .63]  | <b>.61</b>         | [.57; .64]  | <b>.67</b>     | [.64; .70]  | <b>.39b</b> | [.32; .47]  | <b>.46</b>      | [.40; .53]  | <b>.63b</b>          | [.59; .68]  | <b>.57b</b>      | [.51; .63]  |
| $\beta 2$                   | <b>.74</b>  | [.71; .77]  | <b>.60</b>         | [.57; .64]  | <b>.64</b>     | [.60; .67]  | <b>.44b</b> | [.36; .52]  | <b>.39</b>      | [.31; .46]  | <b>.68b</b>          | [.63; .74]  | <b>.66b</b>      | [.60; .72]  |
| $\beta 3$                   | <b>.71</b>  | [.68; .74]  | <b>.55</b>         | [.51; .60]  | <b>.63</b>     | [.59; .67]  | <b>.41b</b> | [.33; .49]  | <b>.43</b>      | [.36; .50]  | <b>.68b</b>          | [.62; .73]  | <b>.59b</b>      | [.53; .65]  |
| <i>Cross-lagged effects</i> |             |             |                    |             |                |             |             |             |                 |             |                      |             |                  |             |
| $\gamma 1$                  | <b>.08b</b> | [.04; .11]  | <b>.09b</b>        | [.05; .14]  | .03b           | [-.01; .07] | <b>.10c</b> | [.04; .16]  | .04b            | [-.01; .09] | .03c                 | [-.01; .07] | <b>.07c</b>      | [.02; .11]  |
| $\gamma 2$                  | <b>.08b</b> | [.04; .11]  | <b>.09b</b>        | [.05; .14]  | .03b           | [-.01; .07] | <b>.12c</b> | [.05; .19]  | .04b            | [-.02; .10] | .04c                 | [-.01; .09] | <b>.08c</b>      | [.03; .12]  |
| $\gamma 3$                  | <b>.08b</b> | [.04; .11]  | <b>.07b</b>        | [.03; .11]  | .03b           | [-.01; .07] | <b>.12c</b> | [.05; .19]  | .04b            | [-.01; .09] | .04c                 | [-.02; .09] | <b>.08c</b>      | [.03; .12]  |
| $\delta 1$                  | <b>.05c</b> | [.01; .09]  | <b>.03c</b>        | [.00; .07]  | .03c           | [-.01; .07] | .01d        | [-.04; .06] | -.04c           | [-.08; .01] | .01d                 | [-.04; .06] | -.01d            | [-.06; .03] |
| $\delta 2$                  | <b>.04c</b> | [.01; .07]  | <b>.04c</b>        | [.00; .08]  | .03c           | [-.01; .07] | .01d        | [-.04; .07] | -.04c           | [-.09; .01] | .01d                 | [-.04; .06] | -.02d            | [-.06; .03] |
| $\delta 3$                  | <b>.04c</b> | [.01; .07]  | <b>.04c</b>        | [.00; .08]  | .03c           | [-.01; .07] | .01d        | [-.04; .06] | -.04c           | [-.09; .01] | .01d                 | [-.04; .06] | -.01d            | [-.06; .03] |
| <i>Correlated residuals</i> |             |             |                    |             |                |             |             |             |                 |             |                      |             |                  |             |
| $\rho 1$                    | .05         | [-.03; .12] | <b>.25</b>         | [.18; .32]  | <b>.14</b>     | [.07; .22]  | <b>.27</b>  | [.18; .36]  | <b>.34</b>      | [.25; .43]  | <b>.41</b>           | [.33; .50]  | <b>.20</b>       | [.11; .30]  |
| $\rho 2$                    | .06         | [-.03; .15] | .04                | [-.06; .15] | .03            | [-.08; .13] | <b>.18</b>  | [.06; .29]  | <b>.33</b>      | [.22; .44]  | <b>.36</b>           | [.25; .47]  | .10              | [-.02; .22] |
| $\rho 3$                    | -.01        | [-.09; .06] | .04                | [-.06; .14] | .03            | [-.07; .14] | <b>.13</b>  | [.00; .25]  | <b>.36</b>      | [.24; .48]  | <b>.33</b>           | [.20; .45]  | .09              | [-.04; .22] |
| $\rho 4$                    | .07         | [-.03; .14] | .05                | [-.05; .14] | <b>.13</b>     | [.03; .22]  | .07         | [-.05; .19] | <b>.33</b>      | [.21; .45]  | <b>.19</b>           | [.04; .33]  | .08              | [-.05; .21] |
| <i>Model fit</i>            |             |             |                    |             |                |             |             |             |                 |             |                      |             |                  |             |
| $\chi^2$                    | 3893.96     |             | 4178.19            |             | 4235.56        |             | 4524.11     |             | 6206.79         |             | 5651.58              |             | 5598.03          |             |
| df                          | 1288        |             | 1288               |             | 1288           |             | 1724        |             | 2802            |             | 2222                 |             | 2500             |             |
| CFI                         | .90         |             | .88                |             | .88            |             | .90         |             | .93             |             | .90                  |             | .91              |             |
| RMSEA                       | .03         |             | .03                |             | .03            |             | .03         |             | .02             |             | .03                  |             | .02              |             |
| SRMR                        | .05         |             | .05                |             | .05            |             | .05         |             | .05             |             | .05                  |             | .05              |             |

Note. CI = Confidence Interval. AT = Achievement Test. GPA = Grade Point Average. GPA was recoded so that higher numbers indicate better performance. All personality and well-being models contained an acquiescence factor.  $\alpha 1$ -3 show the 1-year stability effects of personality across the four measurement points,  $\beta 1$ -3 show the 1-year stability effects of the school-related experiences,  $\gamma 1$ -3 represent the cross-lagged effects from personality to the school-related experiences 1 year later,  $\delta 1$ -3 represent the cross-lagged effects of the school-related experiences on personality 1 year later,  $\rho 1$  represents the initial correlation between the personality trait and the school-related experiences,  $\rho 2$ -4 represent the correlated residuals at each measurement point. Indices a-d show whether the effects were set equal. All effects were controlled for gender, immigration status, school type, socioeconomic status, and cognitive abilities. Bold values show significant effects at a level of  $p < .01$ .

Table OS7

Standardized Parameter Estimates of the CLPM of Agreeableness and School Experiences

|                             | GPA         |             | German language AT |             | Mathematics AT |             | Friends     |             | Teacher support |             | Well-being in school |             | School belonging |             |
|-----------------------------|-------------|-------------|--------------------|-------------|----------------|-------------|-------------|-------------|-----------------|-------------|----------------------|-------------|------------------|-------------|
|                             | Est         | 99% CI      | Est                | 99% CI      | Est            | 99% CI      | Est         | 99% CI      | Est             | 99% CI      | Est                  | 99% CI      | Est              | 99% CI      |
| <i>Stability effects</i>    |             |             |                    |             |                |             |             |             |                 |             |                      |             |                  |             |
| $\alpha 1$                  | <b>.72a</b> | [.66; .78]  | <b>.73a</b>        | [.67; .80]  | <b>.73a</b>    | [.67; .79]  | <b>.73a</b> | [.67; .78]  | <b>.73a</b>     | [.67; .79]  | <b>.70a</b>          | [.64; .76]  | <b>.73a</b>      | [.67; .79]  |
| $\alpha 2$                  | <b>.69a</b> | [.63; .76]  | <b>.70a</b>        | [.63; .77]  | <b>.70a</b>    | [.64; .76]  | <b>.70a</b> | [.64; .76]  | <b>.69a</b>     | [.63; .76]  | <b>.67a</b>          | [.60; .74]  | <b>.70a</b>      | [.63; .76]  |
| $\alpha 3$                  | <b>.73a</b> | [.68; .78]  | <b>.73a</b>        | [.68; .79]  | <b>.74a</b>    | [.69; .79]  | <b>.74a</b> | [.68; .79]  | <b>.73a</b>     | [.68; .79]  | <b>.71a</b>          | [.66; .77]  | <b>.73a</b>      | [.68; .79]  |
| $\beta 1$                   | <b>.57</b>  | [.53; .61]  | <b>.58</b>         | [.54; .61]  | <b>.67</b>     | [.64; .70]  | <b>.41b</b> | [.34; .48]  | <b>.45</b>      | [.38; .51]  | <b>.64b</b>          | [.59; .69]  | <b>.57b</b>      | [.51; .62]  |
| $\beta 2$                   | <b>.73</b>  | [.70; .76]  | <b>.57</b>         | [.53; .61]  | <b>.64</b>     | [.61; .67]  | <b>.45b</b> | [.37; .53]  | <b>.38</b>      | [.31; .45]  | <b>.69b</b>          | [.64; .74]  | <b>.66b</b>      | [.59; .72]  |
| $\beta 3$                   | <b>.71</b>  | [.67; .74]  | <b>.53</b>         | [.49; .58]  | <b>.63</b>     | [.59; .67]  | <b>.42b</b> | [.35; .50]  | <b>.41</b>      | [.34; .49]  | <b>.68b</b>          | [.63; .73]  | <b>.59b</b>      | [.53; .65]  |
| <i>Cross-lagged effects</i> |             |             |                    |             |                |             |             |             |                 |             |                      |             |                  |             |
| $\gamma 1$                  | <b>.21</b>  | [.15; .27]  | <b>.15b</b>        | [.11; .20]  | .04b           | [.01; .07]  | .01         | [-.08; .09] | <b>.09b</b>     | [.04; .13]  | .02c                 | [-.02; .06] | <b>.06c</b>      | [.02; .10]  |
| $\gamma 2$                  | <b>.09</b>  | [.04; .13]  | <b>.15b</b>        | [.11; .19]  | .04b           | [.01; .08]  | <b>.10</b>  | [.02; .19]  | <b>.09b</b>     | [.04; .13]  | .02c                 | [-.03; .07] | <b>.07c</b>      | [.02; .11]  |
| $\gamma 3$                  | <b>.08</b>  | [.03; .13]  | <b>.12b</b>        | [.09; .15]  | .04b           | [.01; .07]  | <b>.15</b>  | [.07; .23]  | <b>.09b</b>     | [.04; .13]  | .02c                 | [-.03; .07] | <b>.07c</b>      | [.02; .11]  |
| $\delta 1$                  | .02b        | [-.03; .06] | .00c               | [-.03; .04] | -.02c          | [-.05; .01] | -.00c       | [-.05; .04] | .00c            | [-.03; .04] | <b>.06d</b>          | [.01; .11]  | .00d             | [-.04; .04] |
| $\delta 2$                  | .01b        | [-.02; .04] | .00c               | [-.03; .04] | -.02c          | [-.05; .01] | -.00c       | [-.05; .04] | .00c            | [-.04; .05] | <b>.06d</b>          | [.01; .11]  | .00d             | [-.04; .05] |
| $\delta 3$                  | .01b        | [-.02; .04] | .00c               | [-.04; .04] | -.02c          | [-.05; .01] | -.00c       | [-.04; .04] | .00c            | [-.04; .04] | <b>.06d</b>          | [.01; .10]  | .00d             | [-.04; .04] |
| <i>Correlated residuals</i> |             |             |                    |             |                |             |             |             |                 |             |                      |             |                  |             |
| $\rho 1$                    | <b>.09</b>  | [.02; .16]  | <b>.31</b>         | [.24; .38]  | <b>.11</b>     | [.04; .18]  | <b>.25</b>  | [.16; .34]  | <b>.26</b>      | [.18; .34]  | <b>.41</b>           | [.33; .49]  | <b>.29</b>       | [.21; .38]  |
| $\rho 2$                    | .04         | [-.06; .14] | <b>.10</b>         | [.00; .20]  | .02            | [-.08; .12] | <b>.20</b>  | [.08; .32]  | <b>.23</b>      | [.12; .34]  | <b>.36</b>           | [.25; .48]  | <b>.18</b>       | [.06; .29]  |
| $\rho 3$                    | .01         | [-.08; .10] | <b>.10</b>         | [.01; .19]  | <b>.09</b>     | [.00; .18]  | .06         | [-.06; .18] | <b>.33</b>      | [.23; .43]  | <b>.31</b>           | [.20; .42]  | .11              | [-.00; .21] |
| $\rho 4$                    | .01         | [-.08; .10] | .04                | [-.05; .13] | <b>.10</b>     | [.01; .20]  | .05         | [-.07; .16] | <b>.21</b>      | [.10; .32]  | <b>.23</b>           | [.10; .36]  | <b>.12</b>       | [.01; .23]  |
| <i>Model fit</i>            |             |             |                    |             |                |             |             |             |                 |             |                      |             |                  |             |
| $\chi^2$                    | 2037.74     |             | 2294.49            |             | 2475.22        |             | 2805.97     |             | 4038.90         |             | 3404.69              |             | 3552.25          |             |
| df                          | 740         |             | 742                |             | 742            |             | 1080        |             | 1968            |             | 1484                 |             | 1714             |             |
| CFI                         | .92         |             | .90                |             | .89            |             | .91         |             | .95             |             | .92                  |             | .93              |             |
| RMSEA                       | .03         |             | .03                |             | .03            |             | .03         |             | .02             |             | .02                  |             | .02              |             |
| SRMR                        | .05         |             | .05                |             | .05            |             | .05         |             | .05             |             | .05                  |             | .04              |             |

Note. CI = Confidence Interval. AT = Achievement Test. GPA = Grade Point Average. GPA was recoded so that higher numbers indicate better performance. All personality and well-being models contained an acquiescence factor.  $\alpha 1$ -3 show the 1-year stability effects of personality across the four measurement points,  $\beta 1$ -3 show the 1-year stability effects of the school-related experiences,  $\gamma 1$ -3 represent the cross-lagged effects from personality to the school-related experiences 1 year later,  $\delta 1$ -3 represent the cross-lagged effects of the school-related experiences on personality 1 year later,  $\rho 1$  represents the initial correlation between the personality trait and the school-related experiences,  $\rho 2$ -4 represent the correlated residuals at each measurement point. Indices a-d show whether the effects were set equal. All effects were controlled for gender, immigration status, school type, socioeconomic status, and cognitive abilities. Bold values show significant effects at a level of  $p < .01$ .

Table OS8

Standardized Parameter Estimates of the CLPM of Conscientiousness and School Experiences

|                             | GPA         |             | German language AT |             | Mathematics AT |             | Friends     |             | Teacher support |             | Well-being in school |            | School belonging |             |
|-----------------------------|-------------|-------------|--------------------|-------------|----------------|-------------|-------------|-------------|-----------------|-------------|----------------------|------------|------------------|-------------|
|                             | Est         | 99% CI      | Est                | 99% CI      | Est            | 99% CI      | Est         | 99% CI      | Est             | 99% CI      | Est                  | 99% CI     | Est              | 99% CI      |
| <i>Stability effects</i>    |             |             |                    |             |                |             |             |             |                 |             |                      |            |                  |             |
| $\alpha 1$                  | <b>.67a</b> | [.63; .72]  | <b>.68a</b>        | [.63; .73]  | <b>.68a</b>    | [.63; .73]  | <b>.67a</b> | [.62; .72]  | <b>.68a</b>     | [.62; .73]  | <b>.64a</b>          | [.57; .70] | <b>.68a</b>      | [.63; .73]  |
| $\alpha 2$                  | <b>.70a</b> | [.64; .75]  | <b>.71a</b>        | [.65; .76]  | <b>.71a</b>    | [.65; .76]  | <b>.70a</b> | [.65; .75]  | <b>.70a</b>     | [.64; .76]  | <b>.65a</b>          | [.58; .72] | <b>.70a</b>      | [.65; .76]  |
| $\alpha 3$                  | <b>.72a</b> | [.66; .77]  | <b>.72a</b>        | [.67; .77]  | <b>.72a</b>    | [.67; .77]  | <b>.72a</b> | [.67; .77]  | <b>.72a</b>     | [.66; .77]  | <b>.68a</b>          | [.62; .74] | <b>.72a</b>      | [.67; .77]  |
| $\beta 1$                   | <b>.58</b>  | [.55; .62]  | <b>.62</b>         | [.59; .65]  | <b>.67</b>     | [.64; .70]  | <b>.39b</b> | [.32; .46]  | <b>.44</b>      | [.38; .50]  | <b>.61b</b>          | [.55; .66] | <b>.56b</b>      | [.50; .61]  |
| $\beta 2$                   | <b>.72</b>  | [.69; .75]  | <b>.61</b>         | [.57; .65]  | <b>.64</b>     | [.61; .67]  | <b>.44b</b> | [.36; .52]  | <b>.37</b>      | [.29; .44]  | <b>.65b</b>          | [.59; .71] | <b>.64b</b>      | [.58; .71]  |
| $\beta 3$                   | <b>.69</b>  | [.66; .73]  | <b>.56</b>         | [.51; .60]  | <b>.63</b>     | [.60; .67]  | <b>.41b</b> | [.34; .49]  | <b>.40</b>      | [.33; .47]  | <b>.64b</b>          | [.58; .70] | <b>.58b</b>      | [.52; .64]  |
| <i>Cross-lagged effects</i> |             |             |                    |             |                |             |             |             |                 |             |                      |            |                  |             |
| $\gamma 1$                  | <b>.12b</b> | [.09; .15]  | <b>.09b</b>        | [.05; .12]  | .03b           | [-.01; .06] | <b>.12c</b> | [.07; .17]  | <b>.10b</b>     | [.05; .14]  | <b>.07c</b>          | [.02; .11] | <b>.10c</b>      | [.06; .13]  |
| $\gamma 2$                  | <b>.12b</b> | [.09; .15]  | <b>.09b</b>        | [.05; .13]  | .03b           | [-.01; .06] | <b>.14c</b> | [.08; .19]  | <b>.10b</b>     | [.06; .15]  | <b>.08c</b>          | [.02; .13] | <b>.11c</b>      | [.07; .15]  |
| $\gamma 3$                  | <b>.12b</b> | [.09; .15]  | <b>.07b</b>        | [.04; .10]  | .03b           | [-.01; .06] | <b>.14c</b> | [.09; .19]  | <b>.10b</b>     | [.06; .15]  | <b>.08c</b>          | [.02; .15] | <b>.11c</b>      | [.06; .15]  |
| $\delta 1$                  | .03c        | [-.01; .07] | .01c               | [-.02; .04] | .01c           | [-.02; .04] | .02d        | [-.02; .06] | .01c            | [-.03; .05] | <b>.09d</b>          | [.03; .15] | .00d             | [-.04; .04] |
| $\delta 2$                  | .02c        | [-.01; .05] | .01c               | [-.03; .04] | .01c           | [-.03; .04] | .02d        | [-.02; .07] | .01c            | [-.03; .06] | <b>.08d</b>          | [.03; .14] | .01d             | [-.04; .05] |
| $\delta 3$                  | .02c        | [-.01; .05] | .01c               | [-.03; .04] | .01c           | [-.03; .04] | .02d        | [-.02; .06] | .01c            | [-.03; .06] | <b>.08d</b>          | [.03; .13] | .00d             | [-.04; .04] |
| <i>Correlated residuals</i> |             |             |                    |             |                |             |             |             |                 |             |                      |            |                  |             |
| $\rho 1$                    | <b>.16</b>  | [.09; .23]  | <b>.16</b>         | [.09; .22]  | <b>.12</b>     | [.05; .18]  | <b>.28</b>  | [.20; .36]  | <b>.36</b>      | [.29; .44]  | <b>.58</b>           | [.51; .65] | <b>.33</b>       | [.25; .40]  |
| $\rho 2$                    | <b>.13</b>  | [.05; .21]  | .04                | [-.05; .13] | .02            | [-.06; .11] | <b>.13</b>  | [.03; .23]  | <b>.29</b>      | [.19; .39]  | <b>.49</b>           | [.40; .58] | <b>.12</b>       | [.02; .23]  |
| $\rho 3$                    | .01         | [-.07; .09] | .06                | [-.02; .14] | .03            | [-.05; .12] | .02         | [-.09; .14] | <b>.34</b>      | [.24; .44]  | <b>.42</b>           | [.32; .53] | .08              | [-.03; .20] |
| $\rho 4$                    | .06         | [-.03; .15] | .06                | [-.03; .14] | <b>.10</b>     | [.01; .19]  | .04         | [-.07; .15] | <b>.29</b>      | [.18; .39]  | <b>.33</b>           | [.20; .45] | .09              | [-.01; .20] |
| <i>Model fit</i>            |             |             |                    |             |                |             |             |             |                 |             |                      |            |                  |             |
| $\chi^2$                    | 2554.46     |             | 2717.19            |             | 2907.12        |             | 3134.25     |             | 4566.00         |             | 3996.93              |            | 3907.93          |             |
| df                          | 908         |             | 908                |             | 908            |             | 1280        |             | 2230            |             | 1714                 |            | 1960             |             |
| CFI                         | .92         |             | .90                |             | .90            |             | .92         |             | .95             |             | .92                  |            | .93              |             |
| RMSEA                       | .03         |             | .03                |             | .03            |             | .03         |             | .02             |             | .02                  |            | .02              |             |
| SRMR                        | .05         |             | .05                |             | .05            |             | .05         |             | .05             |             | .05                  |            | .04              |             |

Note. CI = Confidence Interval. AT = Achievement Test. GPA = Grade Point Average. GPA was recoded so that higher numbers indicate better performance. All personality and well-being models contained an acquiescence factor.  $\alpha 1$ -3 show the 1-year stability effects of personality across the four measurement points,  $\beta 1$ -3 show the 1-year stability effects of the school-related experiences,  $\gamma 1$ -3 represent the cross-lagged effects from personality to the school-related experiences 1 year later,  $\delta 1$ -3 represent the cross-lagged effects of the school-related experiences on personality 1 year later,  $\rho 1$  represents the initial correlation between the personality trait and the school-related experiences,  $\rho 2$ -4 represent the correlated residuals at each measurement point. Indices a-d show whether the effects were set equal. All effects were controlled for gender, immigration status, school type, socioeconomic status, and cognitive abilities. Bold values show significant effects at a level of  $p < .01$ .







# *Chapter 5*

General Discussion



## General Discussion

With the present dissertation I aim for a better understanding of the cross-sectional and longitudinal interplay between the Big Five personality traits and important developmental tasks in adolescence. Accordingly, study 1 provide an overview of the cross-sectional associations between self- and parent rated personality traits as well as achievement-related, social, and adjustment-focused developmental tasks in three different grades of secondary schooling. Study 2 and 3 extend the cross-sectional view by investigating the longitudinal interplay between personality and school-related developmental tasks. The conducted studies yield new differentiated insights about cross-sectional and longitudinal personality associations that can add to the missing theoretical foundation in the field of personality development in adolescence. Moreover, the results contribute to a better understanding of the role personality plays as an individual resource at school and show which experiences contribute to personality development during adolescence. In the following chapter, I summarize the central findings of the three empirical studies and discuss their theoretical, empirical, and practical contribution. Finally, I highlight important limitations of the current dissertation that pave the way for future research on personality and its developmental antecedents and consequences in adolescence.

### Central Findings

Within the scope of three empirical studies I focus on the interplay between personality and school-related developmental tasks in adolescence. The central results refer to the methodological foundation of personality measurement in adolescence, the strong interrelatedness between personality and developmental task domains, the role of age and multi-rater perspectives, and the prediction of subsequent personality and school experiences.

### Methodological Foundation

The reliable assessment of the Big Five personality traits in adolescence provides the basis for all further substantive research questions. The results of mainly study 1 and 3 confirm the findings of previous studies that pointed to a five factor structure in younger age groups, too (e.g. Brandt, Becker et al., 2020). To interpret the distinctive association patterns in relation to developmental tasks, it is important to ensure that differences between age groups, raters, or across time are due to age-related changes or different perspectives on personality and not a result of assessing different constructs across age, raters, or time. Strong measurement invariance was successfully implemented between fifth-, seventh-, and ninth-graders, between self- and parent reports and across multiple measurement points from age 10 to 14. That is,

people with the same underlying score in the construct have equal observed scores regardless of their age or whether they were rated by their parents or each rated themselves. This result lays the foundation for the following cross-sectional comparisons between grades and raters, and the respective longitudinal investigations. Study 3 also shows that the tendency for acquiescence responding in adolescent samples should be controlled for, which highlights a difference to personality assessment in adulthood (see Soto et al., 2008). Consequently, the comparability of the measurement properties becomes particularly visible under the control of the response tendencies.

### **The Interwoven Ties Between Personality and School-Related Developmental Tasks**

The three studies reveal a high cross-sectional interrelatedness that generalizes to longitudinal developmental patterns between personality and school-related experiences (i.e., correlated change). Specific trait-task patterns are only found with respect to academic achievement: Mainly conscientiousness and openness are beneficial in middle adolescence whereas almost all traits contribute to better achievement in early adolescence. This is in line with previous research in adolescence that indicates stronger associations between personality and achievement among younger age groups (Laidra et al., 2007; Poropat, 2009; Tetzner et al., 2020) and also matches with previous findings that underscore the role of conscientiousness and openness for educational attainment (e.g., Nettle & Robins, 2007). Personality positively co-develops with social relationships in school and school specific psychosocial adjustment. However, this relationship surprisingly does not apply to the association between change in agreeableness and change in friendships. These findings underscore the relevance of personality for their experiences at school and support school as a significant context for adolescents' development.

### **Age- and Rater-Specific Associations**

Adolescence is characterized by concurrent biological and environmental changes including the need for adaptation to these requirements of growing up (e.g., Arain et al., 2013; Denissen et al., 2013; Petersen & Leffert, 1995; Steinberg, 2005). To better understand the implications of this turbulent phase, I investigated whether associations between personality and developmental tasks differ by age and between self- and parent perspectives. Overall, these associations show only a few significant differences between grades. Most of the age differences are found in relation to extraversion. Extraverted behaviours relate stronger to school experiences in early adolescence compared to middle adolescence. With respect to the comparison between self- and parent rated personality association patterns, most personality

effects are congruent between raters with slightly more associations in relation to self-rated personality. All significant differences between raters indicate higher associations with self-rated personality compared to parent ratings. Only partly in line with the hypotheses derived from the SOKA model (Vazire, 2010), the majority of significant differences are found for emotional stability and extraversion. These findings support the inclusion of different rater perspectives as they show congruencies and uniqueness but also underscore the use of self-reports in personality assessments even in early and middle adolescence.

### **The Predictive Power of Personality and Developmental Tasks**

All Big Five factors emerge as good predictors for the mastering of developmental tasks in the following years extending cross-sectional findings and pointing to a comparable importance of adults' personality (e.g., Roberts et al., 2007; Soto, 2019). Underscoring that personality should not only be regarded as stable predictor, school-related experiences are also found to be predictive of relative personality change. Results, however, point to more effects of personality on school-related experiences than the other way around. Moreover, only few corresponsive effects emerge, i.e. cross-lagged effects in both directions – the same trait that predicts an experience is also predicted by this experience. Accordingly, conscientiousness relates to the majority of subsequent school experiences of all three developmental task domains, and thus, emerges as the greatest resource at school. Referring to the understanding of personality development, most relative change can be explained in extraversion whereby relevant experiences once again come from all three task domains. One indicator of psychosocial adjustment, however, lays the foundation for positive personality development: Higher well-being in school relates positively to relative change in all Big Five personality traits, except for openness. Thus, personality is crucial for how adolescents manage developmental tasks in school, and its development can also be explained through the related experiences.

Overall, adolescents' personalities interact and co-develop with school-related developmental tasks, emphasizing school as an important context for adolescents' development. The interrelatedness tends to be stronger in early adolescence and for self-reports compared to parent reports of personality. Accordingly, all Big Five personality traits add information to the prediction of almost all school-related experiences whereas well-being in school explains most personality changes across different traits. These findings have theoretical, empirical, and practical implications that will be discussed in more detail in the following paragraphs.

### **What Can We Learn Regarding Personality Development Theory in Adolescence?**

At the beginning, I introduced the Neo-Socioanalytic Model of Personality Psychology (Roberts & Nickel, 2017), that explained personality development in adulthood. For a transferability to the phase of adolescence, I suggested an integration of age-specific developmental tasks (Erikson, 1959; Havighurst, 1972) in the developmental context school (Eccles & Roeser, 2011). Most of the empirical findings of this dissertation support the initial assumptions. As expected, however, some modifications and extensions are needed in order to theoretically regard personality development in adolescence. Similarities and extensions can be summarized in four major points.

First, one common core of developmental theories from personality, development, and educational psychology is that development needs to be understood as the interaction between a person's characteristics and the environment surrounding this person (Baltes et al., 2006; Eccles & Roeser, 2011; Roberts & Nickel, 2017). A main result of the current empirical work emphasizes the strong developmental association between personality and all developmental tasks in the domains of achievement, social relationships, and adjustment. By focusing on the context of school, the findings therefore provide further evidence for an intertwined development of a person and environmental characteristics.

Second, findings of the empirical studies suggest that two of the core development principles formalized in the Neo-Socioanalytic Model (Roberts & Nickel, 2017) can be applied to adolescence, too. Specifically, the plasticity principle and the cumulative continuity principle are supported, as personality changes across the entire phase of adolescence and shows lower rank-order stabilities in early adolescence compared to late adolescence and adulthood (Roberts & DelVecchio, 2000). In stark contrast to assumptions based on the maturity principle, however, findings reveal no increases in emotional stability, agreeableness, and conscientiousness from early to middle adolescence. Instead, developmental trajectories indicate no mean-level change in emotional stability, a slight increase in extraversion, and decreases in openness, agreeableness, as well as conscientiousness. This is in line with prior research and supports the disruption hypothesis (De Fruyt et al., 2006; van den Akker et al., 2014). Thus, conclusions about the applicability of the mechanism that is assumed to drive maturation in adolescence (ie., the social investment principle) are less straight forward. The general joint development of personality and positive school-related experiences points to the relevance of a stimulating context providing different tasks and opportunities to learn instead of a role-specific investment. Consequently, the absence of a personality maturation pattern implies a divergent mechanism.



Third, the results point to psychosocial adjustment as the best predictor of personality development in adolescence, which provides one reason to integrate self-regulatory abilities in future theoretical approaches (Denissen et al., 2013). Besides growing requirements in school and of society (Denissen et al., 2013; Voogt et al., 2013) the development of neuroendocrine processes in adolescent brains as well as cognitive, emotional, social changes occur simultaneously (Arain et al., 2013; Steinberg, 2005; Susman & Rogol, 2004). These biological changes influence the perception of situations as well as the emotional and behavioural answers to them (Ahmed et al., 2015; Kilford et al., 2016). Thus, self-regulatory abilities develop in adolescence and are linked to whether new situations are handled successfully or not. (Moffitt, 1993; Steinberg, 2007). The ability to cope with new situations, not yet reachable states, and the experienced disruptions seems to represent a preceding step. Successful self-regulation is needed to understand and fulfil new roles with their related requirements, and should be included as self-regulation principle. This way, the foundation for the later investment in these new social roles is laid.

Fourth, the results provide strong evidence for the relevance of the selected school-related developmental task domains of academic achievement, social relationships, and psychosocial adjustment. On the one hand, the high cross-sectional and longitudinal interrelatedness with personality highlights the overlap of underlying motives for development (i.e., status/ competence, belongingness/ relatedness, and identity formation/ autonomy) which were derived from the theoretical perspectives of personality, developmental and educational psychology (Eccles & Roeser, 2011; Erikson, 1959; Grob & Jaschinski, 2003; Havighurst, 1972; Hurrelmann & Quenzel, 2015; Roberts & Nickel, 2017). On the other hand, the third domain of adjustment represents an adolescent specific task that is based on developmental and educational perspectives (Deci & Ryan, 2004; Eccles & Roeser, 2011; Erikson, 1959). Thus, the role of developmental tasks should be stronger integrated in the Neo-Socioanalytic Model to provide predictions for adolescence. The currently included social roles in the Neo-Socioanalytic Model only become relevant in young adulthood. Instead, the three domains of developmental tasks including the underlying basic needs of competence, relatedness, and autonomy (Deci & Ryan, 2004; Eccles & Roeser, 2011) better map societal requirements on adolescents. They have also been regarded as decisive domains before (see also Caspi et al., 2005; DeFruyt et al., 2017; Denissen et al., 2019), as they contain situations within which adolescents need to adopt new behaviours to succeed.

Overall, the existing personality development theories focusing on adulthood cannot simply be mapped onto adolescence. Instead, adolescence can be seen as independent crucial

phase for investigating personality and its development. Based on the literature review and the present empirical results I suggest at least three adjustments to the Neo-Socioanalytic Theory (Roberts & Nickel, 2017). First, instead of the maturity principle, a *disruption principle* describes developmental patterns in adolescence more accurately. That is, mean-level personality change is either small or indicate decreases before increasing in late adolescence. Second, a stronger focus on the role of self-regulation by adding a *self-regulation principle* is needed. This means, the development of self-regulation functions as a prerequisite for later maturity-related changes. Third, integrating ideas from developmental and educational perspectives, I suggest a focus on developmental tasks instead of social roles to invest in. Both constructs can motivate personality development but the focus of adolescence is training diverse skills and building an identity before investing specifically in certain social roles. Once these tasks are accomplished, social investment principles can come into play. Future research should test these three suggestions more directly by focusing on a clearer theoretical basis to underpin personality research questions in adolescence.

### **The Power of Personality in Adolescence and the Contributors to its Development**

Applying previous research conclusions about the role of personality in other life stages (Roberts et al., 2007; Müller et al., 2019), the power of personality already becomes evident in adolescence. Although the conducted studies reveal more cross-sectional than longitudinal effects of personality on school experiences (as is usually observed, e.g. Spengler et al., 2016), many cross-sectional findings are surprisingly consistent with respect to correlated change patterns. Moreover, being able to explain relative personality changes through the chosen task domains at school supports the relevance of developmental tasks in adolescence. Thereby, I would like to highlight and discuss five especially interesting findings: First, conscientiousness is the personality trait that shows the most notable cross-sectional and longitudinal significance across domains. Second, personality associations are fairly stable across raters but show differences with respect to self-esteem and extraversion associations. Third, longitudinal effects of personality on school experiences are mostly not corresponsive, meaning that personality traits which appear to be predictive for school experiences differ from those that are explained by these experiences. Fourth, the trait most susceptible to school-related experiences is extraversion. Fifth, well-being at school emerges as the best predictor for relative personality changes.

### **Conscientiousness as General Resource**

Consistent with past research, conscientiousness emerges as a resource across multiple domains (e.g., Dumfart & Neubauer, 2016; Jensen-Campbell & Malcolm, 2007; Tackman et al., 2017). Specifically the strong link between conscientiousness and academic achievement beyond cognitive abilities has already been shown in various (meta-)analyses (Dumfart & Neubauer, 2016; Laidra et al., 2007; Lechner et al., 2017; Poropat, 2009; Spengler et al., 2016). Conscientiousness contains crucial behavioural tendencies for successful learning, such as industriousness, acting organized and responsible as well as being ambitious and self-disciplined (Costa & McCrae, 2003; John et al., 2008).

The positive effects of these characteristics seem to generalize across the other two developmental domains. Although significant associations with social relationship indicators have been reported (Jensen-Campbell & Malcolm, 2007; Zee et al., 2013), reviews and longitudinal studies emphasize especially the role of emotional stability, extraversion, and agreeableness for social relationships (Asendorpf & van Aken 2003; Harris & Vazire, 2016; Selfhout et al., 2010). Several context-specific reasons for the additional relevance of conscientiousness are conceivable. The current dissertation mainly focuses on relevant relationships at school, meaning those with peers and teachers. Teachers are likely to evoke and reward conscientious behaviours (Thijs & Koomen, 2009). Conscientious students, however, have the ability to maintain friendships and can offer support with schoolwork (Jensen-Campbell & Malcolm, 2007; Juvonen, 2006). Another reason relates to the selected relationship indicators (see study 1): Conscientiousness gains importance when also including negative aspects of social relationships such as aggressive or antisocial behaviour (Jensen-Campbell & Malcolm, 2007; Klimstra et al., 2010; Tackett et al., 2014). Consequently, these findings indicate that conscientious behaviours are especially beneficial for less conflictual and stable relationships (Wagner et al., 2014; Zee et al., 2013).

If higher levels of conscientiousness stabilize environmental aspects, conscientiousness should also contribute to better psychosocial adjustment – defined as an ability of adaptation (Piqueras et al., 2019). Although conscientiousness is not the only correlated trait, this assumption is consistent with previous findings – especially in the school context (Butkovic et al., 2012; Evans et al., 2018; Hair & Graziano, 2003; Perret et al., 2019). In line with Evans et al. (2018), the cross-lagged results of study 3 reveal conscientiousness as exclusive trait that predicts well-being in school over time. Possessing conscientious characteristics that particularly fit into the school context not only relates to higher self-esteem but also indicates a more positive time in school. Students with higher levels of conscientiousness might also be

better adjusted at school because they enjoy learning and generally show better persistence strategies when requirements become more difficult (Bakker et al., 2012; De Raad & Schouwenburg, 1996). Moreover, academic success and the feeling of being respected among classmates and by teachers contribute to an increased sense of school belonging (Anderman, 2002; Bird & Markle, 2012; Lam et al., 2015; Uslu & Gizir, 2017).

Overall, these findings extend the importance of conscientiousness as the “main psychological resource” (De Raad & Schouwenburg, 1996, p. 325) to social-emotional domains beyond academic achievement. However, the generalizability of conscientiousness’ relevance to other contexts in adolescence needs to be investigated.

### **The Contribution of Different Rater Perspectives**

The findings from study 1 support the relevance of adolescent self-reports of personality but also underline the value of multiple informants. Both assessments result in overlapping and unique findings that are consistent with previous studies (e.g. Brandt, Becker et al., 2021; Göllner, Roberts et al., 2017; Luan et al., 2017).

With respect to congruent findings, the strong interrelatedness between personality and different developmental tasks are observed across raters, thereby underscoring the robustness of the clearly interwoven ties. A particular strength of this dissertation and especially study 1 is the inclusion of multiple informants not only for personality but also for developmental tasks. Moreover, besides parent and peer ratings, objective test measurements are included. This helps to rule out common-method variance (Podsakoff et al., 2003) as a simple alternative explanation for the significant associations between personality and the chosen developmental tasks. Even though there tend to be a few more significant personality associations among self-ratings, the majority of the significant associations were consistent between raters. Furthermore, only few studies investigated the effect of different perspectives on adolescent personality associations with third variables (e.g., Brandt, Becker et al., 2021; Luan & Bleidorn, 2020; MacCann et al., 2015; Perret et al., 2019) and, more specifically, statistically tested the difference between correlations or effect sizes. After performing this statistical procedure, the overlap of findings becomes even more undisputable, because only some associations differed significantly between raters.

Although both assessments deliver valid information, there is still reason to presume that they rely on different types of information (Luan et al., 2017; MacCann et al., 2015). Other raters have to base their judgements on visible behaviours and rather than adolescents’ thoughts and feelings (Poropat, 2014a; Vazire, 2010). Most differences emerge with respect to self-

esteem and unexpectedly extraversion, whereby self-reports show stronger associations. In adolescence, self-esteem shows a high variability in mean-level changes, which depends on intrapersonal components in peer relationship perceptions (Wagner et al., 2017). The usually low possibility of parents to take part in such processes and observe these situations may generate lower associations with self-esteem. This context-sensitivity could also account for the differences in extraversion associations. Interestingly, within the SOKA-model (Vazire, 2010), extraversion is classified as a trait that is low in evaluativeness and high in observability. Therefore, the overlap of self- and other ratings is expected to be high. Adolescents, however, probably act differently out-going and sociable at school than at home (Fleeson, 2007; Nettle, 2005) as spending time with other students should trigger extraverted behaviour. Moreover, extraverted behaviour results in more positive peer relationships (Asendorpf & van Aken, 2003; Davydenko et al., 2020; Jensen-Campbell et al. 2002; Wagner et al., 2014), and feeling socially included will be positively rewarded in school (Juvonen et al., 2019). Thus, because of extraversion's context-sensitivity, parents are likely to have other information than their children. This information gap is then reflected in rater differences between extraversion associations (see also Brandt, Becker et al., 2021). Depending on the question asked, parents' views can still help to capture the full range of extraverted behaviour of their children.

Taken together, the majority of personality associations are found across raters and show only a few statistically significant rater specificities. This overall congruence implies that adolescents and their parents perceive the adolescents' personalities similarly. Moreover, it indicates a robustness of the high interrelatedness between personality and school-related developmental tasks and supports the validity of personality self-reports in adolescence. As informants still rely on different information, including multiple rater perspectives is useful to get a comprehensive view on someone's personality and thus to evaluate personality associations. When engaging different raters, however, the context-sensitivity of a shown behaviour must be considered (Brandt, Becker, et al., 2021; Tett & Guterman, 2000).

### **The Non-Corresponsiveness of Longitudinal Effects**

Although school-related experiences help to explain relative personality changes, effects of personality on subsequent school-related experiences are pronounced more often and show stronger effect sizes. Thus, how adolescents behave, think, and feel seems generally more important for how they experience school than vice versa. This is in line with previous research also emphasizing the role of personality for mastering developmental tasks (Asendorpf & van Aken, 2003; Caspi et al., 2005; Deventer et al., 2019; Ozer & Benet-Martínez, 2006). Moreover,

despite the general joint development of personality and developmental tasks, only a few corresponsive effect patterns emerge. The corresponsive principle of personality development (Caspi et al., 2005; Roberts & Nickel, 2017) states that personality traits that are prospectively related to environmental variables often seem to be accentuated by the same variables and conditions. However, empirical evidence regarding this mechanism is mixed (Brandt et al., 2019; Jeronimus et al., 2014; Le et al., 2014; Lüdtke et al., 2011; Roberts et al., 2003). Accordingly, researchers suggest that very stable situations rather than specific life experiences promote corresponsive effects (Denissen et al., 2014; Lüdtke et al., 2011; Roberts & Nickel, 2017). In this case, personality traits that are involved in choosing stable environments would corresponsively be predicted by those environments (Denissen et al., 2014). Although quite stable, school is not a chosen context. Adolescents have to attend school and cannot decide if they are graded, who teaches them or if they want to leave school before compulsory education has been completed. This stresses the inclusion of motivational or affective components (Brandt, Israel et al., 2021; Hennecke et al., 2014; Hudson & Fraley, 2015). Adolescents differ in how much significance they attribute to different developmental tasks. For instance, getting good grades becomes generally less important in middle adolescence (Dotterer et al., 2009; Wang & Eccles, 2012), whereas time spent with initiating and maintaining friendships increases (Poulin & Chan, 2010; Way & Greene, 2006). Supporting this assumption, more emotional stable and extraverted adolescents spend more time with friends which also contributes to positive changes in these traits. Thus, future research should investigate if considering the personal relevance of a developmental task, environment, or life experience helps to identify those that can be longitudinally linked to personality development.

Generally speaking, personality is a very good predictor of how adolescents master developmental tasks, whereas normative developmental tasks only partly and rarely corresponsively relate to relative personality changes. Interestingly, extraversion and well-being in school stand out.

### **The Development of Extraversion**

Whereas all traits show cross-sectional links and also co-develop with developmental tasks, good achievement, positive social relationships, and good psychosocial adjustment relate mostly to relative change of extraversion. The personality trait extraversion emphasizes affective and social behaviours (John et al., 2008). Moreover, interactions with peers move into focus in adolescence (Arnett, 1999; Somerville, 2013). One of adolescents' main goals is to belong to a peer group (Szczygiel & Mikolajczak, 2018), and one's first experiences of social

inclusion and refusal are usually made among peers (Bukowski et al., 1993). Based on these experiences and the need to belong, it can be adaptive to modify or improve the social behavioural repertoire (Eccles & Roeser, 2011; Hudson & Fraley, 2015; Smillie et al., 2015). Everyday school life contains many social situations that are reflected in certain relationships with peers and teachers but also in academic achievement and psychosocial adjustment. The containment of social aspects may be less obvious regarding academic achievement. For example, grading is done by teachers who inevitably have expectations of their students, or one's own abilities are automatically reviewed with respect to those from classmates (Schwabe et al., 2019; Televantou et al., 2021). Similarly, with psychosocial adjustment, there cannot be thought of well adjusted adolescents who are not somehow socially accepted in their class (Piqueras et al., 2019). Moreover, the shifting focus – away from studying and getting good grades towards being popular and liked among classmates – can also be observed in the age-differential interplay between extraversion with academic achievement and the teacher-student relationship. In line with previous research (Laidra et al., 2007; Tetzner et al., 2020; Zee et al., 2013), extraverted behaviour positively relates to both tasks in early but not in middle adolescence. This implies a changing role of extraversion with respect to the fulfilment of developmental tasks across adolescence (Chamorro-Premuzic & Furnham, 2008; Eysenck, 1992). On the contrary, the crucial role of peer relationships and adjustment is particularly displayed in the longitudinal effects of friendships and school belonging on relative extraversion change and in the overall positive mean-level trends of extraversion. Thus, the stronger focus on peer relationships can be regarded as the main driver of extraversion development. Future research should explicitly test if the need to belong and the need for autonomy might motivate extraversion development.

In sum, school is more than a context that imparts knowledge. It also provides a stimulating environment to improve social-emotional abilities (Eccles & Roeser, 2010; Weissberg et al., 2015), which is indicated through the prediction of relative changes of extraverted behaviour between adolescents.

### **Well-being in School as Basis for Personality Change**

Study 3 demonstrates strong evidence for well-being supporting adolescents' personality change: Adolescents with a higher well-being in school reported more emotional stable, extraverted, agreeable, and conscientious behaviour on the subsequent years. Except for conscientiousness, an adolescent's personality did not explain changes in well-being, which contradicts previous research (cf. Evans et al., 2018; Perret et al., 2019). Regarding the context

of school, research indicated that enjoying school is beneficial for different outcomes, such as academic achievement and psychosocial functioning (Durlak et al., 2015). Effects of well-being in school on relative personality change as part of a positive development were less in focus. Enjoying school, however, may provide resources for developing another behavioural repertoire. The ability to fit into the context of school might simplify the progression of general adjustment and identity processes, which lay the foundation for later normative trends of the maturity principle (Hill & Edmonds, 2017). Furthermore, well-being in school is a broad conceptualization and, thus, a conglomerate of many different school experiences. Consequently, it provides a similar level of specificity or width and might therefore be a good predictor of relative changes in different personality dimensions (Möttus, 2016). Interestingly, well-being is relatively stable but dips in middle adolescence indicating a similarity of development trajectories of personality traits in adolescence (Coelho et al., 2020; González-Carrasco et al., 2017; Steinmayr et al., 2019). This parallelism could also point to the involvement of third variables or mechanisms, such as self-regulatory processes, that moderate this association. For instance, self-regulation encompasses various biological mechanisms that develop during adolescence (Bell & Deater-Deckard, 2007). It is strongly linked to well-being, as it enables people to control emotional and behavioural responses (Fomina et al., 2020; Howard & Williams, 2018). Moreover, these self-regulatory processes are also needed to fulfil new behavioural requirements and, thus, show personality development (Denissen et al., 2013).

Taken together, the enjoyment of attending school provides a fruitful ground for positive personality changes. Additionally, self-regulatory capacities as underlying mechanism might explain why well-being predicted relative personality change in almost all Big Five traits.

In conclusion, an adolescent's personality – especially conscientiousness – is crucial for the mastering of developmental tasks. This strong interrelatedness was reported across raters, hence supporting the robustness of results and the validity of adolescent self-ratings in personality data collection. School experiences, however, only partly loop back on personality. The high relevance of peer interactions and the strong social connotation of most school-related experiences can explain the link to relative changes in extraverted behaviour. Well-being in school seems to be a general resource for personality changes. Future research needs to clarify whether self-regulatory capacities or motivational aspects might moderate this interplay.



### **Practical Implications for Supporting Positive Development in School**

The present dissertation supports school as crucial developmental context: Adolescents' personality characteristics determine how they experience school and the experiences adolescents gain predict the way they personally change. This raises the question of how school or educational interventions can systematically contribute to positive development. Accordingly, interventions or modifications could target the person or the environment school.

#### **Focus on Conscientiousness?**

Since conscientiousness emerged as a general resource for positive school experiences, an evident intervention target is the adolescent's behaviour. The strengthening of personality characteristics that showed such a strong link to a successful life (Dumfart & Neubauer, 2016; Roberts et al., 2007; Spengler et al., 2018) definitely hits a nerve in society and politics (Bleidorn et al., 2019). Adolescence is identified as a period that is especially susceptible to educational interventions for conscientiousness (Bleidorn et al., 2019; Kautz et al., 2014). Moreover, behaviours are seen as easier targets for interventions than cognitive skills, which generally represent strong predictors of academic success (Borghans et al., 2016; Stankov et al., 2012). In fact, many interventions have already been created to promote "grit" (i.e., "perseverance and passion for long-term goals"; Duckworth et al., 2007), which strongly overlaps with conscientiousness (Ponnock et al., 2020). The created interventions showed mainly positive effects on achievement as chosen outcome (e.g., Alan et al., 2019; Park et al., 2020). Helping students to set appropriate academic goals and pursue them promotes more conscientious behaviour and, thus, successful learning (Tang et al., 2019).

Successful schooling, however, consists of more than teaching self-disciplined, responsible, and diligent learning behaviours. In agreement with research concerning social-emotional learning (Weissberg et al., 2015), the developmental task domains referring to social relationships and psychosocial adjustment underline the broad mission of schooling (Kunter, 2005; Meece & Eccles, 2010). Thus, with respect to the presented results, being emotional stable, extraverted, open-minded, or agreeable also played a role in managing different developmental tasks and functioned as a resource. Additionally, it seems at least ethically questionable to promote the same behaviour in all students through interventions when school already rewards conscientious behaviour by positive feedback and a better overall fit between needs and school offerings (Eccles & Roeser, 2010; Zimmer-Gembeck et al., 2006). Moreover, a functioning society needs diversity (Page, 2007), which is why intervening on mainly one trait might not be the most promising path. Focusing on conscientiousness could neglect other

strengths and even leave those behind who already struggle with working in a self-disciplined and organized manner. Furthermore, we still know little about how the interaction of different traits can contribute to positive school experiences. For instance, including the interaction of two personality traits improved the prediction of work behaviour and social support compared to a singly trait approach (Jensen & Patel, 2011; Swickert et al., 2010; Zaccaro, 2007). Thus, a more holistic view on the interaction of personality characteristics would probably not prefer one trait above the other. Consequently, the concentration on one promising personality trait would do justice neither to the complexity of a person nor to the school context.

### **Strength-Centred Approaches**

A strength-centred approach, however, promotes characteristics that can already be considered a strength and would take the individuality of each student into account (e.g., Burke & Passmore, 2019; Climie & Henley, 2016; Lavy, 2020). Moving away from deficit-focused interventions implies that adolescents concentrate on existing resources and, consequently, are enabled to find solutions for the demands placed on them more quickly (Climie & Henley, 2016). Studies on strength-based interventions already provided evidence for positive effects on achievement, self-efficacy, and well-being but were mostly applied in therapeutic or work-related contexts (e.g., Ghielen et al., 2017; Proyer et al., 2013; Seligman et al., 2009). In that sense, promising interventions may also amplify mechanisms that simplify the dealing with potential challenges in everyday school life. With regard to the theoretical underpinnings of this dissertation such mechanisms might contain self-regulatory capacities. Self-regulation has been linked to subsequent development as well as to positive academic and well-being outcomes in adolescence (Fomina et al., 2020; Howard & Williams, 2018). Self-regulation abilities are seen as a foundation for many other developmental processes (Baumeister & Vohs, 2007; Bell & Deater-Deckard, 2007; Denissen et al., 2013). Hence, self-regulation interventions applied in early adolescence could lead to more positive developmental trajectories during adolescence, including the maturation of personality traits (Howard & Williams, 2018; Schonert-Reichl et al., 2015). Future research should explore whether strength-based interventions and the fostering of self-regulation are able to promote personality development and how these interventions can be possibly implemented in classes.

### **Fostering Well-Being**

In line with previous research supporting the positive role of well-being in school (Bird & Markle, 2012; Strózik et al., 2016), the present results indicate that adolescents who enjoy school also show positive personality changes. The relevance of well-being is also illustrated

by the fact that adolescents are confronted with an increasing number of stressors that relate to their mental health (Bothe et al., 2014; Woods & Pooley, 2015). Accordingly, well-being in school can be understood as the context-related basis for positive development and should therefore be actively promoted. That means school should provide their students with enough resources to manage all requirements (Dodge et al., 2012), which could be reached through improved teaching methods, individualized learning offerings, and a stimulating environment (Barry et al., 2017; Chodkiewicz & Boyle, 2017). The importance of adolescents' well-being has already been acknowledged by education authorities and was followed by an effort to integrate new teaching contents in the curriculum (Chernyshenko et al., 2018; OECD, 2015). With the goal of ensuring general well-being and psychosocial adjustment, teachers are increasingly encouraged to teach social-emotional skills and coping abilities (Chodkiewicz & Boyle, 2017; Lewis et al., 2011). Social-emotional learning interventions were shown to be strong indicators of follow-up well-being and demonstrated the enhancement of positive youth development (Taylor et al., 2017). Despite their great potential, a systematic nationwide integration of evidence-based interventions on social-emotional learning is still not accomplished in most countries (Barry et al., 2017). Reasons for this are the time-consuming implementation of interventions, already full curriculums, big class sizes, necessary teacher training, and missing financial resources (Chodkiewicz & Boyle, 2014; Toland & Boyle, 2008). One possible strategy lies in the use of technical solutions that at least simplify the logistic implementation (Stevenson, 2013). Moreover, considering the individual needs and developmental trajectories of each student, it is difficult to create one singular helpful intervention or fruitful environment for all. Since realistically only one or a few interventions can be carried out, such an intervention should be as broad and diverse as possible (Chodkiewicz & Boyle, 2017; Zimmerman et al., 2008). This way, school would provide an environment that supports and rewards different personality characteristics and offers the opportunity to grow on the accomplishment of various developmental tasks.

Overall, schooling is crucial for the development of adolescents, as it is an unequalled context in terms of systematic outreach to their students. Ideally, creating a diverse environment that includes interventions focusing on a broad set of skills, strengths, and behaviours has a great potential of supporting positive (personality) development in adolescence.

### **Limitations and Outlook**

The current dissertation provided new insights into the cross-sectional and longitudinal interplay between personality and different developmental tasks in adolescence. Despite several

theoretical, empirical, and practical contributions some limitations have to be kept in mind and should be considered in future research.

First, the interplay of personality and developmental tasks was considered in the context of school. It was, however, neither possible to map the whole context of school, nor to look at all variables associated with developmental tasks. Although a broad range of different school experiences was included, it can be assumed that not all relevant indicators or domains have been studied in this dissertation. For instance, additional achievement-related indicators could also refer to more motivational constructs, such as goal setting (Duckworth et al., 2007), learning strategies (Diseth, 2003) or self-concepts (Marsh et al., 2006). On the one hand, motivation can be understood as dispositional characteristic just as the Big Five (see also Roberts & Nickels, 2017). On the other hand, motivation and personality are not only interrelated but their interplay explains occupational outcomes several years later (Brandt, Israel et al., 2021). Focusing on developmental tasks, a more detailed operationalisation of identity formation as condition for later maturity processes was already shown to be a promising path (Hill et al., 2013; Hill & Edmonds, 2017). Interestingly, especially the association patterns of personality with social relationships and psychosocial adjustment were highly similar. Besides the shared explanation of a great relevance of social-emotional learning for an adolescent's development (Domitrovich et al., 2017; Taylor et al., 2017; Weissberg et al., 2015), one should also acknowledge that the indicators of these domains are interrelated (Zins et al., 2004). For example, psychosocial adjustment indicators contain a social component as feeling integrated is one aspect of being adjusted (Piqueras et al., 2019). Future research therefore needs to account for the contextual overlap of constructs and also to investigate whether certain domains, single indicators, or their interaction are predicted by or drive personality change in adolescence.

Second, as it is challenging to capture important environmental aspects for adolescence, the focus on one important context that combines a diverse set of developmental tasks was shown to be helpful. Nevertheless, other crucial contexts for adolescents' development are also worth investigating. As different situations trigger different expressions of traits, it is likely to observe context-specific associations between developmental tasks and adolescents' personality (Fleeson & Jayawickreme, 2015; Tett & Guterman, 2000). Trait specific resources in school, such as being emotionally stable, might not reach the same importance in the family context (Branje et al., 2004). Moreover, the role of developmental tasks that include certain dyadic interactions can be easier observed in other contexts. Becoming independent from one's parents and the linkage to personality changes, for example, should be investigated in the family

context (Branje, 2018). The development of peer relationships on the contrary might deserve a closer look during freetime activities (Hogan & Roberts, 2004; Reitz et al., 2014; Scholte & van Aken, 2006). Thus, future research needs to clarify the generalisability of the found personality-school experience associations to other contexts.

Third, an additional approach to identifying relevant antecedents and consequences of personality development in adolescence would be the examination of this interplay on different levels. This was suggested in personality (e.g., Brandes et al., 2020; Möttus, 2016) and educational psychology (Stage-Environment Fit Theory; Eccles & Roeser, 2010). Other levels in personality psychology would imply analyses on item or facet level, which might lead to a more differentiated association pattern or provide explanations for contradicting findings (Bergold & Steinmayr, 2018; Brandes et al., 2020; Judge et al., 2013; Möttus, 2016). For instance, Margolis et al. (2020) showed that the link between extraversion and well-being solely relies on the facet energy level. Identifying the involved facets simplifies the understanding of these associations and might also explain which environmental characteristics can support a positive development during adolescence. With respect to the Stage-Environment Fit Theory (Eccles & Roeser, 2010), the current dissertation focused on what is referred to as level 1: indicators from classroom environments such as social interactions with teachers and peers and academic achievement. Broader school characteristics (level 2), such as culture or resources, or even district policies (level 3) would have at least two additional advantages: They represent objective criteria of an environment and, hence, prevent from associations through common-method variance (Podsakoff et al., 2003). Second, if those criteria play an overarching role in a student's development, it could be easier to implement targeted interventions to provide a positive school environment for children and adolescents in the long-term (Chodkiewicz & Boyle, 2014).

Fourth, despite the analysis of large longitudinal data sets, it is not possible to draw any conclusion about involved processes based on the present studies alone. The current dissertation, however, identified relevant domains and indicators that are potentially part of the underlying personality development processes. Results indicate that a more intensive analysis of specific traits such as extraversion, and indicators such as well-being could be worthwhile in order to examine the process level of personality development. Identifying underlying processes would include the consideration of several data specificities (see also Baumert et al., 2017). First, more fine-grained assessments and, thus, more measurement points comprising different time periods are helpful to capture short- and long-term as well as non-linear personality changes (Jayawickreme et al., 2019; Luhmann et al., 2014; Wrzus & Roberts, 2017).

To measure such short-term or even micro-level processes, daily diary data or experience sampling methods moved into focus as promising study designs (Horstmann, 2021; Sherman et al., 2015). Second, the decomposition of stable and variable parts of personality as well as of environmental factors, as for example proposed by the trait-state-occasion (TSO) model (Cole et al., 2005), can provide a better understanding of if, when, and to what amount personality changes (e.g., Abrahams et al., in press; Geukes et al., 2018; Wagner et al., 2019). This model also allows the estimation of continuous age effects and can therefore be applied when short-term assessments are not available. Third, multimethodological and multi-rater information, including for example lab and field assessments, physiological measures, behavioural experiments, smartphone sensing data, and round robin rater designs, are necessary to receive a more complete picture of a person's personality and the captured environment (Geukes et al., 2017; Wrzus & Mehl, 2015). Such comprehensive designs, however, are quite expensive and time consuming, which is why a fundamental understanding of basic interrelatedness with personality factors can simplify the focus on specific variables.

Fifth, the described associations relied on non-experimental data and, consequently, does not allow any causal inferences as third variables could account for alternative explanations (Morgan & Winship, 2015). As a matter of fact, I would even suggest that other development processes are involved and should also be investigated. A particularity of adolescence compared to adulthood is that the development of the brain is not yet complete (Arain et al., 2013; Blakemore et al., 2010; Keating, 2004). Moreover, the contextual differentiation of the Big Five structure in late compared to early adolescence (Soto & Tackett, 2015) may point to a possible involvement of parallel cognitive, emotional, self-regulatory and neural-biological developmental processes (Ahmed et al., 2015; Bell & Deater-Deckard, 2007; Howard & Williams, 2018). Therefore, by disentangling genetic, biological, and environmental as well as their stable and variable factors, future research might get closer to the sources and outcomes of personality development (Briley et al., 2018; Wagner et al., 2020; Wrzus & Roberts, 2017). Moreover, causality is a controversial topic in the field as a controlled manipulation of personality or school-related experiences is difficult to realize (Costantini & Perugini, 2018; Grosz et al., 2020; Möttus, 2016). Volitional personality trait changes and carefully planned controlled interventions, however, mark two potential entry points to support causal reasoning (Allemand & Flückinger, 2017; Constantini & Perugini, 2018; Hudson & Fraley, 2015).

## **Conclusion**

In summary, adolescence marks a distinct phase of personality development and its interplay with environmental factors. Personality, however, indicate a comparable importance in adolescents' life as it has also been shown in adulthood. The Big Five play a key role in how adolescents experience school that provides a normative and enduring setting with diverse cognitive, social, and emotional associated developmental tasks. The high interrelatedness between personality and these school experiences is supported across different perspectives on personality and all three developmental task domains. Zooming into this broad picture, conscientiousness can be regarded as the greatest resource for mastering school-related developmental tasks. Especially how much adolescents enjoy being in school loops back on their personality changes, whereby extraversion was most susceptible to school experiences in general. Thus, school interventions that foster well-being by promoting a diverse set of academic but also social-emotional strengths and skills can support adolescents in their overall development. Building the foundation, revised theoretical frameworks for personality development in adolescence are needed to investigate underlying processes. Possible involved mechanisms could be found in self-regulatory and neurobiological processes and should be examined in future studies. Furthermore, as adolescence is a phase marked by many parallel changes and new experiences, future research should also disentangle context-sensitive stable and variable parts of personality and rely on multi-rater and multimethodological assessments.

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## Appendix

Table S1

*Empirical Longitudinal Studies on Big Five Personality Development in Adolescence*

| Study  | N     | Ages MT1<br>(age span)             | Design        | Traits<br>(Inventory)                     | Rater   | Correlates  | Main results  |
|--|-------|------------------------------------|---------------|---|---------|---|---|
| Asendorpf & van Aken, 2003 (German LOGIC study)                                  | 174   | 12 (12–17)                         | 2w, 5yrs      | All (Ostendorf's bipolar adjective pairs) | Self    | Perceived support from family and friends   | C predicted father's support; E predicted peer support; support did not predict personality; correlated change between E and peer support, A and peer/maternal support  |
| Borghuis et al., 2017 (Dutch RADAR study)  | 920   | 2 cohorts<br>13.5, 16.5<br>(12–22) | 7w/6w,<br>1yr | All (Goldberg's Big Five Questionnaire)   | Self    | Personality trait trajectories of adolescent friends and siblings; moderators of co-development (gender, age, relationship quality) | Rank-order stability from 12–16: .68–.84 and then remained stable; mean-level changes: ES (girls), E, C (boys) inverse quadratic change, O (boys), A, C (girls) increased, O (girls) quadratic change; co-development: no co-development with personality trajectories of adolescents' friends and siblings   |
| Borghuis et al., 2020 (Dutch RADAR-Young study)                                  | 1,046 | 13.1 (13–18)                       | 6w, 1yr       | N (Goldberg's Big Five questionnaire)     | Self    | Negative affect, interpersonal conflict   | Changes in N were bidirectionally and positively associated with changes in daily negative affect; rank-order differences in conflict were positively related with subsequent within-person changes in N  |
| Brandes et al., 2020 (Canadian Child Personality and Behavioural Outcomes Study) | 440   | 10 (9–13)                          | 4w, 1yr       | All (ICID-S)                              | Mothers | Gender  | Rank-order stability from T1–T4 .63–.72; mean-level changes of domains: ES increased, E, O decreased, A, C (girls) increased; facet-level stability and change: substantial facet-level personality stability, small to moderate linear change in 13 of 15 facets, heterogeneous facet-level change patterns in ES, E, O, gender facet differences in change mainly in E, C |

|   |   |                                     |              |   |                                |   |   |
|---|---|-------------------------------------|--------------|---|--------------------------------|---|---|
| Branje et al., 2007<br>(Dutch Nijmegen Family and Personality Study)        | 285 (families with two adolescent children, round robin design) | 13.5 (11–18)                        | 3w, 1yr      | All (Goldberg's Big Five questionnaire) | Self, mother, father, siblings | Perceived support, life events, perceived pubertal timing, gender | Mean-level changes self-reports: E (boys) decreased, E (girls) quadratic change; O (girls), A (girls), C (girls) increased; mean-level changes other reports: E (boys), O (boys) decreased, E (girls), C (girls) increased; variance of adolescents' personality development trajectories was predicted by maternal support, pubertal timing, number of life events, number of positive life events, and number of negative life events |
| Branje et al., 2004<br>(Dutch Nijmegen Family and Personality Study)        | 285 (families with two adolescent children, round robin design) | 13.5 (11–18)                        | 3w, 1yr      | All (Goldberg's Big Five questionnaire) | Self, mother, father, siblings | Perceived support (PS)  | No adolescent personality effects on PS changes; no effects from PS on personality changes for all members; correlated changes between all Big Five factors and perceived support from family members, that were strongest for A  |
| De Bolle et al., 2012<br>(Dutch subsample of PALS + Dutch community sample) | 717   | 10.7 (8–14)                         | 3w, 1 + 2yrs | All (HiPIC)                             | Mothers                        | Psycho-pathology  | Correlated change between all Big Five and psychopathology  |
| De Fruyt et al., 2006<br>(Dutch family studies)                             | 2 samples: 498 + 548 (siblings + twins)                         | 2 samples: 10.9 (10–18), 8.7 (5–14) | 2w, 3yrs     | All (HiPIC)                             | Parents                        | Genetics  | Mean-level changes: in early adolescence ES slightly increased, O, C slightly decreased; continuity mainly explained by genetic and nonshared environmental factors   |
| Göllner, Roberts et al., 2017<br>(German TRAIN study)                       | 2,761   | 10.7 (10–14)                        | 4w, 1yr      | All (BFI-44; parents: BFI-10)           | Self, parents                  | Gender  | Self-ratings: E increased, O, A, C decreased; parent ratings: ES increased, E, O, A decreased; self- and parent ratings of girls showed higher O, A, C  |
| Göllner, Damian et al., 2017<br>(German TRAIN study)                        | 2,76  | 10.7 (10–14)                        | 4w, 1yr      | C (BFI-44; parents: BFI-10)             | Self, parents                  | Homework effort in German and mathematics                         | Self- and parent reports: C predicted increases in homework effort; homework effort predicted increases in C; correlated change between C and homework effort   |



|   |       |                                    |           |  |      |  |  |
|---|-------|------------------------------------|-----------|--|------|--|--|
| Greischel et al., 2016<br>(German PIRATS study<br>+ a recruited control<br>group) | 741   | 15.7 (14–<br>17)                   | 3w, 2-7ms | All (BFI-42)                                     | Self | Spending a year<br>abroad, social<br>relationships | Rank-order stabilities from T1–T3: .79–.86; mean-level changes: all participants: ES slightly decreased, E slightly increased, O, A, C stable; personality effects on sojourn status: ES, E, A positively predicted spending a year abroad; sojourn effects on personality development: buffered decreases in ES, steeper increase in O, A; fluctuating social relationships partially mediated sojourn effects on ES, O development   |
| Hair & Graziano, 2003<br>(American sample of<br>middle school students)           | 317   | n.i.                               | 2w, n.i.  | All<br>(Goldberg's<br>Big Five<br>Questionnaire) | Self | Academic<br>adjustment and<br>behaviours           | Rank-order stability .23–.58; no mean-level changes; A predicted better behavioural conduct and classroom behaviour, O predicted better scholastic competence and academic adjustment and behaviours   |
| Heaven & Ciarrochi,<br>2008 (Australian<br>Wollongong Youth<br>study)             | 784   | 12.3 ()                            | 2w, 1yr   | C (self-<br>designed 16-<br>item measure)        | Self | Parental style,<br>academic school<br>grades       | Mean-level changes: C decreased; authoritative parenting style predicted less decreases in C; decrease in C predicted worse grades   |
| Hill et al., 2013 (Swiss<br>students)   | 750   | 14.9 (14–<br>16)                   | 2w, 1yr   | All (BFI-K)                                      | Self | Identity   | No significant mean-level changes; significant inter-individual variability in change; correlated changes between E, C and identity  |
| Klimstra et al., 2009<br>(Dutch CONAMORE<br>study)                                | 1,313 | 2 cohorts<br>12.4, 16.7<br>(12–20) | 5w, 1yrs  | All<br>(Goldberg's<br>Big Five<br>questionnaire) | Self | Gender   | Rank-order stabilities: .31–.62 (early to middle adolescence boys), .27–.75 (middle to late adolescence boys), .41–.75 (early to middle adolescence girls), .52–.86 (middle to late adolescence girls); mean-level changes: ES increased and remained stable for girls from middle to late adolescence, E slightly increased, O (girls) stable and then slightly increased, O (boys) slightly increased and then stable, A increased, C (boys) decreased to middle adolescence and then stable |

|   |         |  |                      |   |                                   |  |   |
|---|---------|--|----------------------|---|-----------------------------------|--|---|
| Klimstra et al., 2010<br>(Dutch CONAMORE study)   | 1,313   | 3 cohorts<br>12.4, 16.7<br>(12–20)                                 | 5w, 1yrs             | All<br>(Goldberg's<br>Big Five<br>questionnaire)          | Self                              | Problem behaviour<br>symptoms:<br>Depression (D),<br>aggression (AG)                 | Personality effects on later D: negative effects of ES, E, C;<br>D effects on personality: negative effects on ES, E, A, C;<br>correlated changes between ES, E, A, C and D; personality<br>effects on later AG: negative effects of O, A, C; AG effects<br>on later personality: negative effects on ES, A; correlated<br>changes between ES, O, A, C and AG |
| Luan et al., 2017 (S1:<br>German LOGIC sample;<br>S 2: Dutch Family<br>Personality Research<br>Project) | S1: 186 | S1: 12 (12–<br>29)   | S1: 3w, 5<br>+ 12yrs | All (S1:<br>Ostendorf's<br>bipolar<br>adjective<br>pairs) | S1: Self,<br>parents              |  | S1: mean-level change mainly from age 17 to 29; self-<br>ratings: O, A, C increased; parent ratings: ES, O, A, C<br>increased; highest self-parent agreement in C, followed by<br>E, lowest agreement in ES, O  |
|   | S2: 576 | S2: 5<br>cohorts<br>11.5, 12.5,<br>13.5, 14.5,<br>15.5 (11–<br>19) | S2: 3w,<br>1yr       | All (S2:<br>Goldberg's<br>Big Five<br>Questionnaire)      | S2: Self,<br>parents,<br>siblings |  | S2: self- and sibling ratings: O, A, C increased; parent<br>ratings: ES increased, O, A decreased; self-sibling<br>agreement in developmental trajectories for ES; self-other<br>agreement: highest for E, C; lowest for ES, A  |
| McCrae et al., 2002<br>(American panel study of<br>gifted students)                                     | 230     | 12 (10–17)   | 2w, 4yrs             | All (NEO-<br>FFI)   | Self                              | Gender   | Rank-order stabilities: .30–.63 (girls), .31–.49 (boys); mean-<br>level changes: ES (girls) decreased, O increased, C<br>decreased  |
| Pullmann et al., 2006<br>(Longitudinal Study of<br>Estonian Schoolchildren)                             | 876     | (12–18)  | 2w, 2yrs             | All (NEO-<br>FFI)   | Self                              | Intelligence,<br>academic<br>achievement   | Rank-order stabilities: generally increased from early to late<br>adolescence from .51 to .67; mean-level changes: ES<br>decreased, E increased in early adolescence, O increased in<br>middle and late adolescence; no moderation effect of<br>intelligence and achievement on personality stability   |
| Rieger et al., 2017<br>(German TRAIN study)   | 3,876   | 11 (10–14)   | 4w, 1yr              | All (positive<br>worded items<br>of BFI-44)               | Self                              | Cognitive<br>constructs:<br>individual interest,<br>self-concept,<br>academic effort | Rank-order stability of Big Five .37 – .47; rank-order<br>stability of cognitive constructs .36 – .50; mean-level<br>changes: O, C decreased; similar amount of stable variance<br>and amount of change in personality and cognitive<br>constructs  |

|  |     |                         |   |             |                         |   |   |
|--|-----|-------------------------|---|-------------|-------------------------|---|---|
| Tackman et al., 2017<br>(American subsample of a neuroimaging study) | 90  | 10 (10–16)              | 3w, 3yrs  | C (EPSI-C)  | Self                    | Academic, health, and relationship functioning        | Rank-order stability from T1–T3: .25; mean-level change: C decreased from 10–13 and increased from 13–16; correlated changes between C and grades, school engagement, positive school climate, depression, physical activity, and friend supportive behaviour   |
| van den Akker et al., 2010 (Dutch FSPPD)                             | 290 | 8.8 (8–15)              | 3w, 2yrs  | All (HiPIC) | Mother, father, teacher | Adjustment problems (AP), overreacting parenting (OP) | Rank-order stabilities of Big Five from T1–T3 .31 – .64; mean-level changes: E, O, C decreased; A predicted increasing OP; OP predicted increasing ES, A; negative correlated change between ES, A and OP; all Big Five negatively predicted increasing AP; negative correlated change between ES, E and AP   |
| van den Akker et al., 2014 (Dutch FSPPD)                             | 596 | 7.5 (6–20)              | 5w, 2-3yrs (mother reports T1-T4; self-reports T2-T5) | All (HiPIC) | Self, mother            | Gender, parenting                                     | Rank-order stabilities of Big Five: for mother reports (T1–T4) .47–.62, for self-reports (T2–T5) .33–.44; mean-level change mother reports: ES (boys) inverse quadratic change, ES (girls) cubic change, E, O decreased, A, C (boys) quadratic change, C (girls) cubic change; Mean level change self-reports: ES (boys) quadratic change, ES (girls), E decreased, O, A, C inverse quadratic change; personality predicted changes in parenting, less so parenting predicted changes in personality, significant correlated change between personality and parenting |
| Vecchione et al., 2012 (Italian subsample of a longitudinal project) | 403 | 2 cohorts<br>16 (16–20) | 3w, 2yrs  | All (BFQ)   | Self                    | Gender  | 2-year rank-order stability: .50–.67; mean-level changes: ES (boys), O, A (boys), C increased, A (girls) inverse quadratic change; girls showed higher O, A, C  |

*Note.* ES = Emotional Stability, E = Extraversion, O = Openness, A = Agreeableness, C = Conscientiousness, w = number of waves, yrs = years between assessments, ms = months between assessments, n.i. = no information.