

# Personality and the Intergenerational Transmission of Educational Attainment: Evidence from Germany

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**Abstract** Research based in the United States, with its relatively open educational system, has found that personality mediates the relationship between parents' and child's educational attainment and this mediational pattern is especially beneficial to students from less-educated households. Yet in highly structured, competitive educational systems, personality characteristics may not predict attainment or may be more or less consequential at different points in the educational career. We examine the salience of personality in the educational attainment process in the German educational system. Data come from a longitudinal sample of 682 17 to 25 year-olds (54% female) from the 2005 and 2015 German Socio-Economic Panel (SOEP). Results show that adolescent personality traits—openness, neuroticism, and conscientiousness—are associated with educational attainment, but personality plays a negligible role in the intergenerational transmission of education. Personality is influential before the decision about the type of secondary degree that a student will pursue (during adolescence). After that turning point, when students have entered different pathways through the system, personality is less salient. Cross-national comparisons in a life course

framework broaden the scope of current research on non-cognitive skills and processes of socioeconomic attainment, alerting the analyst to the importance of both institutional structures and the changing importance of these skills at different points in the life course.

## Introduction

In modern Western societies, academic success in adolescence is highly consequential to the subsequent life course, with occupational, health, familial, and economic path dependencies spanning well into the adult years (e.g., Baeckman and Nilsson 2011; Due et al. 2011; Ritchie and Bates 2013). Educational performance and attainment result from the interplay of young people's social background and their cognitive and non-cognitive skills (e.g., Farkas 2003; Vuolo et al. 2013; Wang and Sheikh-Khalil 2014). A prominent set of non-cognitive skills refers to personality—conceptualized as relatively stable behavioral propensities that transcend specific circumstances—and of interest is its role for educational performance and attainment. Extant evidence comes mainly from research in psychology (e.g., Beaujean et al. 2011; Swanberg and Martinsen 2010) and economics (Almlund et al. 2011b; Ferguson et al. 2011).

Missing from this research, however, has been the study of social institutions, most prominently the structuring of educational systems and the life course, which directs attention to the importance of educational transitions. The study of institutions is increasingly recognized as necessary in order to fully grasp the ways in which social background and personality characteristics interact and jointly affect educational outcomes (Blossfeld et al. 2016). To fully appreciate this conceptualization, a comparative perspective is necessary, one that is based on substantial differences in

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the institutional structuring of educational systems. Most research on personality and education has occurred in the United States (US), with its uniquely structured system. One aim of the present study is to put some of the recent evidence from the US into comparative perspective by examining the role of personality in the very differently-structured German system.

Social reproduction theorists contend that the role of educational systems is to legitimate and reproduce pre-existing disparities in social, cultural, and psychological capital (Bourdieu 1984). According to this perspective, different types of capital, including personality traits, shape educational processes among youth to the extent that they produce students who conform to middle-class preferences (Lareau 2003). Bowles and Gintis (2002) theorize that behavioral attributes, including personality, contribute to the intergenerational transmission of status because high-status parents possess personality characteristics that are valued in the workplace, and they transmit these personality characteristics to their children (i.e., a mediational pattern). In turn, characteristics such as conscientiousness, openness, and emotional stability are rewarded in the classroom.

Social closure theorists, on the other hand, contend that it is the structure of available positions that matters most for status transmission (Grusky and Sørensen 1998; Weeden 2002). According to this perspective, educational attainment reflects a contest among students for the available positions (Sørensen 1983). The influence of individual characteristics like personality varies by the rules used by the system to allocate people into positions. Because testing and credentials act as barriers to entry into sought-after positions, we hypothesize that more credentialed systems reduce the influence of personality. Accordingly, movement into relatively elite educational positions hinges on performance, especially with respect to educational continuation past secondary school, when parental influence likely wanes (Featherman and Hauser 1978).

The social reproduction and social closure models suggest different expectations regarding the role of personality as a mediator of the parental-child educational attainment link. Both perspectives are agnostic about the intriguing possibility that low-status children may benefit more than children of high status parents from such characteristics. That is, both high- and low-status parents have the potential to raise children with valued personality traits but the issue then becomes whether personality can compensate for low parental status. Given low-status parents with little access to middle-class cultural and social capital, can personality compensate for these “deficits?” Evidence suggests compensatory processes in the US, which works to the advantage of some low-status students; however, this pattern may not be observed in Germany because of the less salient role of personality in education.

In this article, we examine the intergenerational transmission of educational attainment among German youth. The educational system in the US is among the least credentialed among similar advanced capitalist countries due to its underdeveloped vocational training system and emphasis on general education (Iversen and Stephens 2008). In contrast, Germany has a considerably more credentialed system given its strong vocational training system, relatively low participation rate in university education, and allotment of students to different pathways based on performance relatively early in their educational careers (Shavit and Müller 2000). We begin by examining the structural nature of the German educational system and then consider the possible salience of personality in the transmission of education across generations in this context.

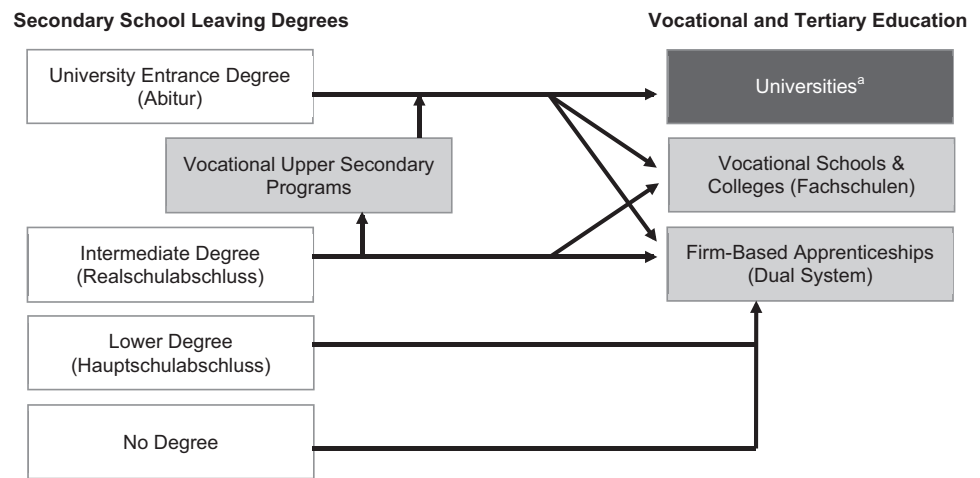
### The German Educational System

Compared to comprehensive educational systems, such as those in the UK or the US, the German system has been characterized as an example of the “early tracking model” (Blossfeld et al. 2016), with its comparatively high level of differentiation and gate-keeping mechanisms occurring relatively early in the educational career. There are three parts to the German educational system (see Fig. 1): (1) primary or elementary school (not shown), (2) secondary school, and (3) post-secondary education in the form of vocational or tertiary education (including various vocational education and training programs and university).

The secondary school degrees are frequently decisive in granting access to the different forms of vocational or tertiary education. The sorting at the secondary school juncture is therefore important for future educational attainment. Students are tracked by ability around age 10 to 12 (after four to six grades) into one of three secondary school tracks: the upper track where students can obtain an Abitur—the university entrance degree (attained after grades 12 or 13, depending on the state); the intermediate track towards the Realschulabschluss (after grade 10); or the lower track towards the Hauptschulabschluss (after grade 9 or 10) (see e.g., Witte and Kalleberg 1995; Protsch and Solga 2016; Buchholz et al. 2016; Lauterbach and Fend 2016). Students are sorted into these secondary school tracks based on previous grades, teachers’ recommendations, and choice (rules of access partly differ among the federal states). One caveat, however, is that recent research has pointed to an often underestimated prevalence of students’ track mobility, especially in terms of upgrading to higher degrees after the first (lowest) degrees have been obtained (Buchholz et al. 2016; Lauterbach and Fend 2016).

While adolescents completing the upper secondary track then have the credentials to attend university or different types of vocational training, those completing the

**Fig. 1** The German educational system (most important pathways). <sup>a</sup> Includes degrees from universities of applied sciences and dual study programs. *Source:* Protsch and Solga (2016, p. 640) adopted and simplified by authors



intermediate track head towards vocational schools and colleges or firm-based apprenticeships, and those completing the lower track may enter apprenticeships. The vocational education and training system consists of vocational upper secondary programs, vocational schools and colleges (Fachschulen), and firm-based apprenticeships—commonly called the dual system. Indeed, most secondary school leavers go on to complete some form of vocational training. However, in practice, students who do not obtain an intermediate degree or an Abitur often find themselves unable to obtain a position in the vocational training system: in 2012, 68% of students entering firm-based apprenticeships and 81% entering the vocational schools and colleges had an intermediate degree or an Abitur, respectively (Protsch and Solga 2016; Bildungsbericht 2014: Autorengruppe Bildungsberichterstattung 2014).

Interestingly, some gender differences have been observed, most likely due to the different occupations one can possibly assume after completion of the programs. Women make up more than three-quarters of students in vocational schools and colleges and receive training in “health, social work, and media, including nurses, kindergarten teachers and medical assistants” (Protsch and Solga 2016, p. 638). More men complete an apprenticeship than women, and the skill among the occupations is wider-ranging, from semi-skilled (mechanic, clerk) to more skilled (IT specialist) (Protsch and Solga 2016). On the level of tertiary education, there are several types of universities and many forms of university degrees. For our purposes, however, it is sufficient to group all university degrees together as the highest form of education (the dark box).

The German Federal Ministry of Education and Research reports that the proportion of students obtaining a lower secondary school degree was about 27% in 2006, while the proportion of students obtaining an intermediate degree was about 46%, and about 43% obtained the credentials for entering university (including general university and

universities of applied sciences). As students can consecutively obtain different degrees, for example those obtaining the intermediate degree can go on to obtain a university entrance degree through a vocational upper secondary program, some students may be double-counted in the official statistics (Bildungsbericht 2014: Autorengruppe Bildungsberichterstattung 2014).

The particular characteristics of the German system—offering relatively clearly delineated positions and pathways and the allotment to these pathways based on performance, particularly assessed in the early grade levels—contrasts considerably with the U.S. educational system, which requires mass participation through universal secondary school, and encourages mass participation in university or college education (based on diverse criteria of accepting students). These organizational differences suggest that, in Germany, personality might play an important role in one’s educational career with respect to the transition to secondary school in particular, because the choices made during this transition often (but not always) set students on a path for the rest of their educational careers.

### Mechanisms Linking Social Background, Personality, and Education

Given the early age at which students are tracked in Germany, parental knowledge, engagement, and parental decision-making are highly predictive of educational careers in Germany. Highly educated parents are more likely than others to provide additional support for the child’s learning gains when it comes closer to a tracking deadline, and they tend to engage in the realization of relatively high educational aspirations for their child by means of decision-making during the actual transition process (Maaz and Nagy 2009). Research also shows that low SES parents are less likely to send their children to higher educational tracks not only when such a decision would be

incongruent with the teachers' recommendation, but also when teachers did recommend allocation to a high school track (Ditton and Kruesken 2006), likely reflecting different aspirations, understanding of the importance of education, and socioeconomic habitus of the family (Heinz 2009).

Personality may have an impact on educational outcomes beyond social background, and several mechanisms have been proposed for how adolescent personality has the potential to shape educational outcomes, most notably as part of an individual's motivational system (Poropat 2009). Yet personality may also influence how students think of themselves and their education, such that certain personality traits may help students commit to education and visualize their educational successes (Klimstra et al. 2012; Lundberg 2013). Personality characteristics have also been linked to educational engagement among youth and adolescents, including school attendance (Lounsbury et al. 2004) and in-class skills and behaviors that lead to educational success (De Raad and Schouwenburg 1996; Spengler et al. 2015).

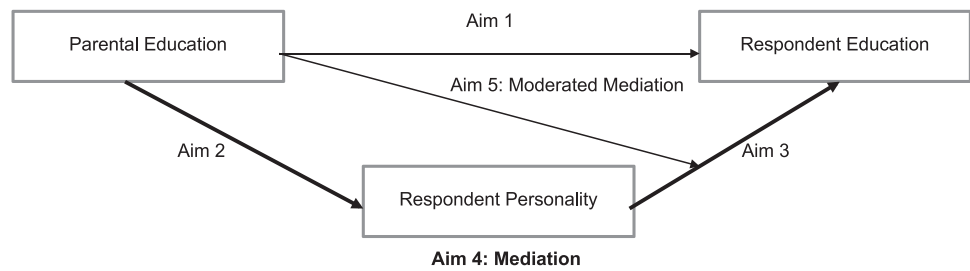
Personality is most commonly studied empirically through an examination of the "Big Five" traits: openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism (the inverse of emotional stability). Meta-analyses of studies published in English (and based largely on American samples) have shown that conscientiousness, openness to experience, and agreeableness are all positively related to academic performance, while extraversion may be negatively related to academic performance (Borghans et al. 2008; McAbee and Oswald 2013; O'Connor and Paunonen 2007; Poropat 2009; Richardson et al. 2012). Across studies, conscientiousness has the largest and most consistent association with academic performance, and this relationship actually strengthens once intelligence is taken into account (Poropat 2009). Openness to experience and agreeableness have smaller effect sizes. Notably, though, openness to experience may be the personality trait most related to years of education as an outcome, rather than grades or other measures of performance (Borghans et al. 2008). The evidence is mixed on extraversion, but some studies have shown that it is negatively related to post-secondary GPA (O'Connor and Paunonen 2007; Richardson et al. 2012).

Several studies of German respondents examine the potential impact of the more structured German educational system, but must be distinguished by how they operationalize education. Studies consistently find negative effects of extraversion and neuroticism on educational outcomes, including years of education, earning an Abitur or university degree, or quickly transitioning to the vocational system (neuroticism only; Almlund et al. 2011a; Anger 2013; Protsch and Dieckhoff 2011). Openness to experience may be positively related to educational outcomes along the university track, including earning an Abitur and university degree (Anger 2013; Uhlig et al.

2009), but negatively related to other outcomes including years of education (Almlund et al. 2011a) and timely transitions to vocational training (Protsch and Dieckhoff 2011). Conscientiousness also has mixed relationships to educational outcomes and may be more positively related to outcomes along the vocational track (Almlund et al. 2011a; Anger 2013; Protsch and Dieckhoff 2011; Uhlig et al. 2009). A major caveat of the extant studies, however, is that personality was measured after education was likely completed. Although personality is considered a stable individual difference in mid-adulthood, it nonetheless is subject to sufficient change during early life and early adulthood to warrant caution in interpreting these studies (Lucas and Donnellan 2011; Roberts and DelVecchio 2000).

While extraversion and neuroticism are consistently negatively related to educational outcomes in Germany, the mixed findings surrounding openness and conscientiousness may in part reflect the methodological weaknesses of the above studies, or the closed nature of the German educational system. The opportunities for personality's influence to manifest may be at key turning points in the German educational system: transitions from primary to secondary school, and from secondary school to vocational school or university. Protsch and Dieckhoff (2011) argue that personality is especially important during the transition from secondary school to vocational school. In particular, they hypothesized that personality may be especially important for students with intermediate secondary degrees as they have more opportunity to put it to use in applying for positions than students with lower secondary degrees whose positions rely more on grades.

Although there is considerable evidence regarding associations between personality and education, far fewer studies have examined the role of personality in educational transmission across the generations, or the "return" on personality by parental status. Evidence from the US suggests that personality can mediate the association between parental and offspring's education (albeit weakly), and that this effect is larger for students from low SES households (Shanahan et al. 2014). Studies using German data report conflicting findings regarding the role of personality in the intergenerational transmission of education. Uhlig et al. (2009) found that personality is more influential for students from more educated families. However, personality does not contribute to the differential risks of underachievement by parental education. Rather, the differences in underachieving by parental education are due to differential decisions about types of schooling by parents from different classes. Anger (2013), in contrast, found that men from more disadvantaged backgrounds (defined based on mother's education and family structure) received a greater education benefit from openness to experience than men from more advantaged backgrounds.

**Fig. 2** Study aims

## Current Study

The current study seeks to assess both the relationship between young people's personality and educational attainment and the role of personality in the intergenerational transmission of educational attainment in Germany. Five specific aims guide our analysis (see Fig. 2). First, we examine the association between parental education and the respondent's education (Aim 1). Second, we examine the link between parental education and respondent personality traits (Aim 2). Third, we examine the relationship between personality and two key educational outcomes in Germany: the type of secondary school degree earned, and ultimate educational attainment (Aim 3). We next examine whether personality mediates the relationship between parent and respondent's education (Aim 4). The final step in our analysis is to examine whether personality traits play a greater role for young adults coming from households with lower levels of parental education (Aim 5).

## Methods

### Data

Data for this study come from the German Socio-Economic Panel (SOEP; doi: 10.5684/soep.v31; Wagner et al. 2007). The SOEP, which began in 1984, is an ongoing nationally representative panel study. Personality measures were introduced into the SOEP in 2005. Parental education data were collected in earlier waves of data collection, either from the parent directly, or from the focal respondent (Haisken-DeNew and Frick 2005). Measures of respondent education were taken from the 2015 wave, the most recent wave available.

### Participants

The analytic sample for this study is restricted to respondents ages 25 and younger in the 2005 wave of the SOEP who provided information on educational attainment in the 2015 wave ( $N = 714$ ). A small number of these respondents ( $n = 32$ ) were missing data for either parental education or

one of the personality dimensions. After excluding these respondents, the analysis sample for educational attainment includes 682 respondents while the analysis sample for secondary degree type is 557 respondents. The sample size is smaller for secondary degree type because this variable had higher levels of missing data, and respondents who reported other types of secondary degrees ( $n = 17$ ) were dropped. Respondents in the analytic sample live across both East and West Germany, were 17–25 years old when personality was assessed in 2005, and 27–35 years old when educational outcomes (both secondary degree type and ultimate educational attainment) were measured in 2015. They are approximately evenly distributed by gender (see Table 1).

## Measures

### Educational attainment

Because the German educational system is highly structured (Witte and Kalleberg 1995), we use two categorical variables as outcomes that correspond to the German educational system: secondary school degree and highest educational attainment. Secondary school degree type determines access to the university, the vocational schools and colleges (Fachschulen), and the dual system of firm-based apprenticeships. This variable is ordered and categorical as follows: 1 = no secondary school degree, 2 = lower secondary school degree, 3 = intermediate school degree, 4 = degree from an upper secondary vocational training program,<sup>1</sup> and 5 = upper secondary degree.

Most secondary school leavers go on to complete some form of post-secondary education. We utilize a 4-category variable for educational attainment that is inclusive of all types of post-secondary education in Germany: 1 = secondary degrees or less with no vocational training [sec], 2 = apprenticeships and equivalent vocational training [app], 3 = masters and technicians [tech], and 4 = university degrees [univ]. Educational attainment is measured categorically as the highest level of education completed.

<sup>1</sup> This degree corresponds to the "vocational upper secondary programs" in Fig. 1.

**Table 1** Descriptive statistics

	Mean	SD	Range
Age in 2005	21.00	2.66	17–25
Female	0.54	0.50	0,1
West Germany in 2005	0.71	0.46	0,1
Agreeableness in 2005	16.12	2.87	6–21
Conscientiousness in 2005	16.04	3.14	5–21
Extraversion in 2005	14.64	3.60	3–21
Neuroticism in 2005	11.88	3.49	3–21
Openness in 2005	14.03	3.34	3–21

$N = 682$

Parental education is measured using the parent with the highest level of education.

### Respondent personality

The personality measures come from the Big Five Inventory-Short form (BFI-S)—a 15-item set of measures based on the original Big Five Inventory. Each of the Big Five personality traits is measured with three items on a 7-point Likert scale ranging from Does not apply to Applies. After appropriate reverse-coding, scales for the five dimensions are created as the sum of the appropriate items (three items for each dimension) (Gerlitz and Schupp 2005).

The reliability and validity of these measures has been examined among German populations. They are considered robust across adulthood (Lang et al. 2011) and they have convergent and discriminant validity with the traditional NEO-PI-R domains and facets of personality (Costa and McCrae 1992; Hahn et al. 2012). However, as there are just three items per personality trait, not all facets of each trait are covered. The breadth of facets making up neuroticism, extraversion, and conscientiousness are considered well-represented, but the measures do not fully cover all facets of openness and agreeableness. In particular, openness is made up of fantasy, aesthetics, feelings, actions, ideas, and values, but the BFI-S measure of openness concentrates on the creative areas of these facets leaving out feelings, actions, and values. The trait agreeableness is thought to be made up of trust, straightforwardness, altruism, compliance, modesty, and tendermindedness, while the BFI-S assesses forgiveness, straightforwardness, and friendliness (Costa and McCrae 1992; Hahn et al. 2012).

### Respondent gender

Respondents report their gender at multiple waves of the SOEP. The variable SEX from the PPFAD data file is

considered the most reliable version of a respondent's gender, as it is verified across waves.

### Region

Respondents reported their federal states of residence. We then classified these into East and West Germany.

### Analysis

The analysis to assess the five aims proceeds in several steps. Aim 1 is addressed through the use of a mobility table indicating the proportion of respondents at each level of parental education that attain different levels of respondent education. Aim 2 is addressed using standard regression models with parental education and socio-demographic characteristics (age, gender, and region) predicting each dimension of respondent personality. Aim 3 has two components: (1) examining the associations between personality and secondary school degree, and (2) examining the associations between personality and ultimate educational attainment. A series of ordered logit models are used for both outcomes (Long 1997). The first model only includes the personality dimensions; the second model includes the personality dimensions, parental education, and the sociodemographic measures; and the third model for ultimate educational attainment includes indicators for the type of secondary school degree as an additional predictor.

Addressing Aims 4 and 5 involves the specification of simultaneous equation models as follows:

$$P_i = \alpha_1 + \beta'_1 \text{ParEdu}_i + \beta'_2 x_i + \epsilon_i \quad (1)$$

$$\text{ordered logit}[\text{ResEdu}_i] = \alpha_2 + \gamma'_1 \text{ParEdu}_i \quad (2)$$

$$+ \gamma'_2 P_i + \gamma'_3 x_i$$

where  $i$  indexes cases,  $P$  represents a vector of the five personality dimensions,  $\text{ParEdu}$  represents a vector of indicators for different categories of parental education,  $x$  is a vector of sociodemographic covariates (age, gender, and region),  $\epsilon$  is a vector of error terms, and  $\text{ResEdu}$  represents respondent education (either secondary degree type or educational attainment) and is treated as an ordered categorical measure with an ordered logit link in Eq. (2). The simultaneous equation model facilitates the estimation of the indirect effects of parental education on respondent education via each dimension of personality (i.e., mediation). To address Aim 5, interaction terms between the indicators for parental education and the dimensions of

personality are added in Eq. (3)

$$\text{ordered logit}[ResEdu_i] = \alpha_2 + \gamma'_1 ParEdu_i + \gamma'_2 P_i + \gamma'_3 ParEdu_i \times P_i + \gamma'_4 x_i \quad (3)$$

In addition to the primary analyses addressing the specified aims, a number of sensitivity analyses were conducted to assess the robustness of the results. The auxiliary analyses included (1) shifting the age cut-off from 25 to 24 years old, (2) stratifying the analysis by gender, (3) stratifying the analysis by region, and (4) separating father's and mother's education.

Stata 14 was used to prepare the data for analysis and for obtaining parameter estimates from all of the single equation regression models (StataCorp 2015). The simultaneous equation model parameter estimates were obtained using Mplus v7.2 (Muthén and Muthén 1998). All code for data preparation and analysis is maintained at a publicly available website (<https://github.com/sbauldry/gsoep>) to facilitate replication and extensions.

### Results

Table 2 reports the joint distribution of parent (i.e., the highest level of education among mothers and fathers) and respondent education. Consistent with past studies, a clear pattern is evident: parents with higher levels of education disproportionately tend to have high attaining children. However, some degree of mobility can also be observed. For instance, for parents with vocational educational background, the proportion of respondents with a university degree is 25%, and the proportion of respondents with vocational education is 53%. For parents holding a university degree, the proportion of offspring also holding a university degree is 67%, while 22% of the respective offspring pursued some kind of vocational education.

**Table 2** Relationship between parental education and respondent education

	Respondent education in 2015				Marginal
	sec	app	tech	uni	
Par edu: sec	0.49	0.46	0.00	0.06	0.05
Par edu: app	0.18	0.53	0.04	0.25	0.48
Par edu: tech	0.08	0.41	0.05	0.47	0.12
Par edu: uni	0.08	0.22	0.03	0.67	0.35
Marginal	0.15	0.40	0.04	0.41	

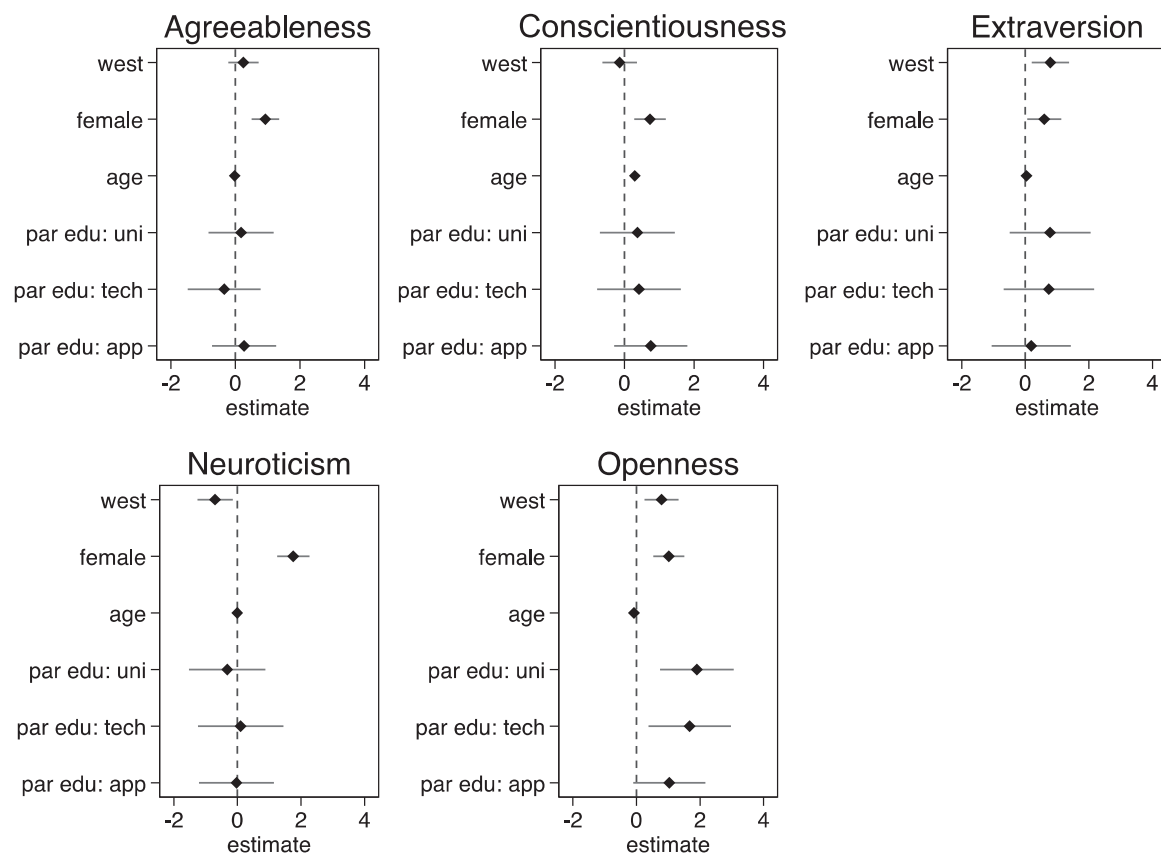
N = 682

Note: Proportions are calculated by row

The second aim concerns whether there are any associations between parental education and the different dimensions of personality, net of sociodemographic factors. Figure 3 reports the parameter estimates (and 95% confidence intervals) from regression models predicting each dimension of personality. Openness is the only dimension that is related to parental education. A university degree and a technical degree are both associated with higher levels of openness relative to a secondary degree or less and no vocational degree. In terms of the size of the associations, the estimates for a university degree ( $b = 1.90$ ) and for a technical degree ( $b = 1.67$ ) represent about half of a standard deviation for openness, which is a considerable magnitude. Apparently, parents with tertiary educational backgrounds tend to raise children who develop particularly high levels of openness. This may be a consequence of home environments fostering the development of openness but it may also be a reflection of intergenerational transmission of personality traits (i.e., more open parents raising more open children).

As noted above, the third aim has two components. The first component involves assessing the associations between different dimensions of personality and the type of secondary degree respondents obtained. The second component involves assessing the associations between personality and ultimate educational attainment. Figure 4 reports the parameter estimates from ordered logit models for each of the personality dimensions. In the top panel, both the unadjusted (Model 1) and adjusted (Model 2) models indicate a positive association for openness and negative association for neuroticism and conscientiousness with secondary degree type. For instance, a one-unit increase in openness (equivalent to roughly a third of a standard deviation) is associated with a 15% increase in the odds of achieving a higher level of secondary degree. Similarly, a one-unit increase in neuroticism (also equivalent to roughly a third of a standard deviation) is associated with a 10% decrease in the odds of achieving a higher level of secondary degree.

The bottom panel of Fig. 4 reports the odds ratios for personality and ultimate educational attainment. In Models 1 and 2, there is a positive association for openness and a negative association for neuroticism, though the associations are somewhat smaller in magnitude than those observed for secondary degree type. For instance, a one-unit increase in openness is associated with a 6% increase in the odds of achieving a higher level of educational attainment. Model 3 adds secondary degree type as an additional predictor of educational attainment. The inclusion of secondary degree type renders the associations for openness and neuroticism non-significant, though statistical tests for attenuation are also non-significant. This pattern combined with the larger effect sizes suggests that personality



**Fig. 3** Parameter estimates with 95% confidence intervals from regression models predicting personality dimensions in adolescence and young adulthood.  $N = 682$ . The referent category for parental education is secondary degree or less and no vocational education

dimensions may play a more significant role earlier in the education process.

The fourth aim concerns whether any of the personality dimensions represent an important pathway through which parental education contributes to respondent education. Figure 5 reports the estimates of indirect effects based on the simultaneous equation models specified in Eq. (1) and Eq. (2). Given the results for Aims 2 and 3, it is not surprising that most of the indirect effects are not statistically significant. The only statistically significant indirect effect is for parents with a university degree via openness, but the effect size is quite small. In the context of all of the parameters being tested, one would conclude that there is no solid evidence that personality is a pathway by which parental education is associated with child's education.

The fifth aim concerns whether any indirect effects of parental education on respondent education vary across levels of parental education (i.e., moderated mediation). As discussed above, this aim was assessed by introducing interaction terms into the simultaneous equation model as illustrated in Eq. (3). Given the estimates of indirect effects reported above, the analysis focused on openness. None of the interaction terms between openness and the different levels of parental education were statistically significant for

either secondary degree type or ultimate educational attainment (estimates not shown).

### Sensitivity Analyses

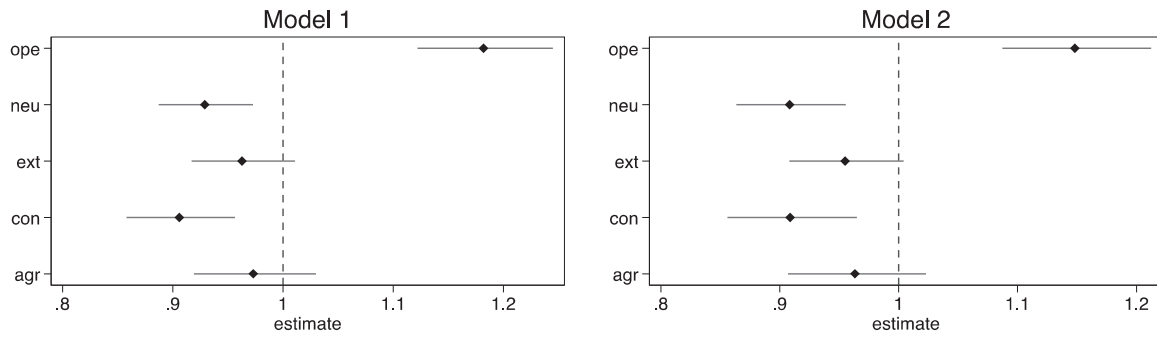
Auxiliary analyses included (1) shifting the age cut-off from 25 to 24 years old, (2) stratifying the analysis by gender, (3) stratifying the analysis by region, and (4) separating father's and mother's education. In virtually all cases, the same substantive pattern of associations was observed across the five aims, though the diminished sample sizes did result in some non-significant estimates (e.g., for East Germans). The one case that deserves more attention in future studies is the gender-stratified results. The parameter estimates revealed stronger associations between parental education and openness for women than for men; however, the difference in estimates between women and men were not themselves statistically significant.

### Discussion

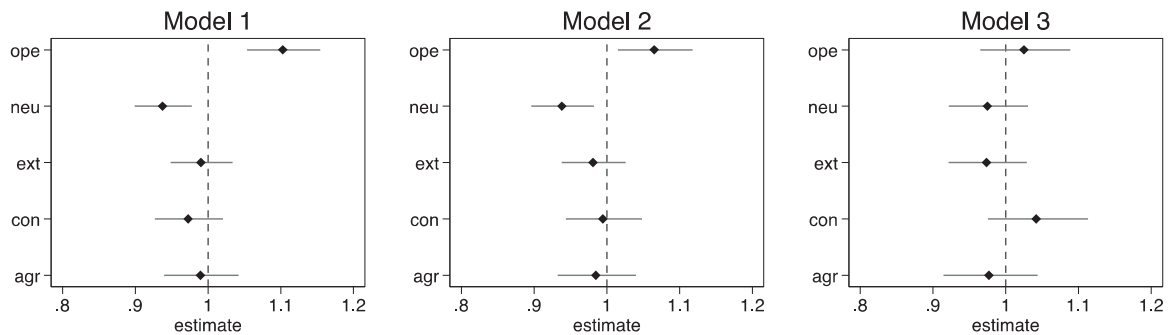
The German education system is highly structured, with students tracked into educational pathways via secondary



## Secondary Degree Type



## Educational Attainment



**Fig. 4** Parameter estimates (odds ratios) and 95% confidence intervals from ordered logit models predicting secondary degree type and ultimate educational attainment. For both outcomes, Model 1 just includes the different dimensions of personality and Model 2 adds parental education and sociodemographic characteristics (age, gender, and region). For ultimate educational attainment, Model 3 adds indicators for secondary degree type with the referent set to upper secondary

degree. The sample size for the secondary degree type model is 557. The sample size for Models 1 and 2 for educational attainment is 682 and the sample size for Model 3 for educational attainment is 557. Auxiliary Models 1 and 2 were also fit to the same sample as Model 3 (i.e., the sample with information on secondary degree type) and the same pattern of results was found

school placement at approximately age 10 to 12 and into vocational or academic post-secondary education after obtaining their secondary school degrees. We hypothesized that such a system might render personality less salient in helping students achieve educational success. In such a system, cognitive ability and parental monitoring and intervention are likely more important to educational performance and attainment. This article examined whether adolescent personality predicts educational attainment, the role of personality in the intergenerational transmission of education, and whether personality is more advantageous for students from less educated families in Germany. Several conclusions are supported, although analytic limitations render our conclusions suggestive.

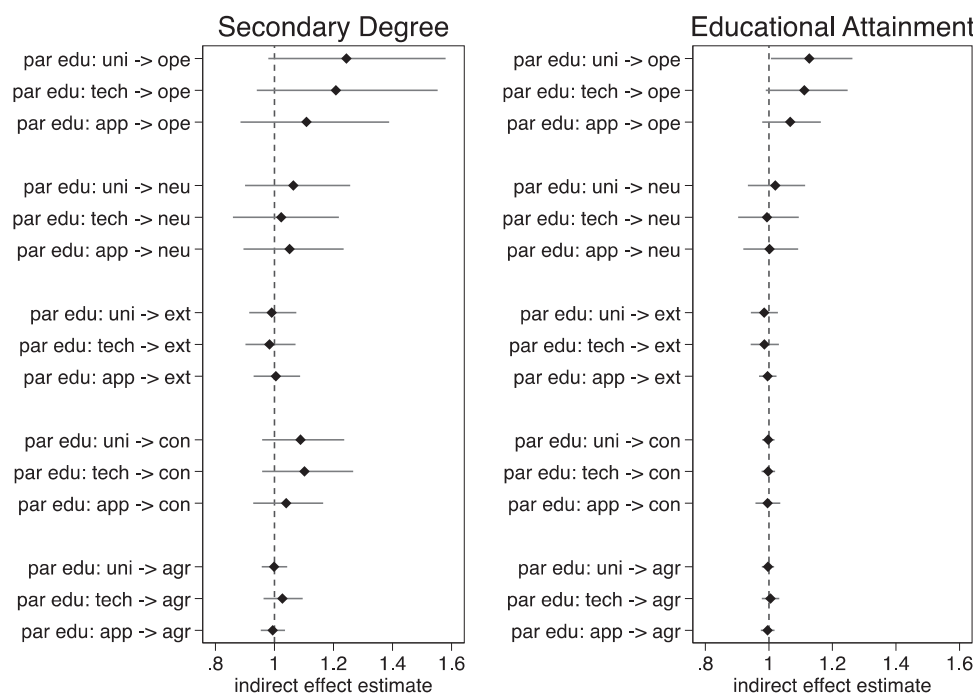
First, we find that parental education is a strong predictor of the respondent's education in Germany (Aim 1). This finding is not surprising given the well-documented stratification in the German educational system and the high level of social reproduction (Müller and Pollak 2010; Powell and Solga 2011; Shavit and Müller 2000).

There is little association, however, between parental education and respondent personality in Germany (Aim 2). Openness is the only personality trait related to parental education. Respondents with highly educated parents have more openness.

A respondent's own personality is related to their educational attainment (Aim 3), though not in the same ways as previous research has demonstrated in the US (Borghans et al. 2008; McAbee and Oswald 2013; O'Connor and Paunonen 2007; Poropat 2009; Richardson et al. 2012). Individuals that are more open to experience tend to achieve higher levels of secondary degrees and higher levels of ultimate educational attainment, while neurotic individuals tend to complete lower levels of secondary degrees and have lower overall educational attainment.

Conscientiousness is related to achieving lower levels of secondary degrees, but is not related to overall educational attainment. This finding is notable, as conscientiousness tends to be the strongest personality predictor of educational attainment in the US (Poropat 2009). However, it is in line

**Fig. 5** Parameter estimates (odds ratios) and 95% confidence intervals of indirect effects of parental education on respondent education via each dimension of personality. Simultaneous equation models are based on the Model 2 specifications for both secondary degree type ( $N = 557$ ) and ultimate educational attainment ( $N = 682$ )



with previous German studies, which found that conscientiousness is linked to lower likelihoods of attaining an Abitur and graduating from university (Anger 2013), and extreme levels of conscientiousness increase one's chances of underachieving based on cognitive potential (Uhlrig et al. 2009). Recent research has pointed to an important distinction between two facets of conscientiousness: focus and orderliness (Kaiser and Diewald 2014). In their study of school-aged German children, Kaiser and Diewald found that only the facet "focus" is both socially stratified and related to students' school performance. It may thus be a promising avenue for future research to examine dimensions of personality traits.

Because parental education is not strongly related to respondent personality, it is not surprising that we found no convincing evidence supporting mediation or moderated mediation (Aims 4 and 5). At the same time, Anger (2013) reports that, in Germany (using SOEP data), openness was particularly useful for men from low SES backgrounds. The differing results may well reflect differences in samples (with Anger's research including respondents aged 24 and above for whom there is personality data from the 2005, 2009, or 2010 surveys) and the operationalization of educational outcomes (with Anger's research focusing on obtaining a university-entrance diploma and graduating from the university). The present study, however, suggests that personality does not appear to play a significant role in the intergenerational transmission of education in Germany, nor to compensate for coming from a family with less educated parents.

We hypothesized that the structured nature of the German education system may limit the impact of personality on individual achievement. Students are tracked early in their educational careers and have limited opportunities to change educational tracks (Protsch and Solga 2016). The limited number of available spots at each step of the educational system (aka social closure) results in earlier sorting having consequences for latter opportunities. We find support for social closure theory, and, in particular, for the limited role of personality after the secondary degree has been obtained. The influence of openness and neuroticism on educational attainment disappear once the type of secondary degree one earns is taken into account. Personality may be more influential earlier in the educational career in Germany, particularly when one is choosing which type of secondary degree to earn. Once this crucial decision has been made, the role of personality may be negligible in predicting one's ultimate educational attainment.

Yet this conclusion must be considered provisional and perhaps a starting point for subsequent research given several limitations. First, this article examines adolescent engagement in only one case: the German educational system. Although suggestive, one should be cautious in generalizing the results to other countries and institutions. Our findings suggest that personality plays a more limited role in such systems, but future studies should explore other cases of highly structured systems (e.g., other instances of ability tracking resembling the German model, as found in Switzerland; other relatively closed systems as found in

China; and still other systems that are more comparable to the US).

Methodologically, the present study is limited in that it does not include intelligence as an additional predictor of educational attainment. It is important for future studies to include intelligence, as it can minimize the importance of personality (Damian et al. 2014). Additionally, the analyses predicting the type of secondary degree may be subject to endogeneity bias since personality was not necessarily measured before secondary school degrees were likely completed. The findings for secondary degree type strongly align with those for ultimate educational attainment, which was measured after personality, so it is unlikely that any endogeneity bias is substantial. Nevertheless, personality was assessed after the first track allocation, suggesting caution when interpreting the results.

Despite these limitations, this article provides evidence in support of social closure, and future research should test this idea in additional structured systems, beyond the German educational system. Future work should examine a broader array of status attainment outcomes, including employment, wages, and occupational prestige, across a range of institutional settings. Research should examine a range of institutional settings, from the most closed (such as presented here) to the most open, and variances in between, with clear focus on the role of personality at different points in the educational career. In particular, future research should focus on other turning points in adolescent development. Here we considered transitions in the realm of sequential educational achievement in Germany, but other turning points in which personality and other personal characteristics may also be influential include entry into the job market, and buying one's first home.

## Conclusions

The highly structured German educational system tracks students into educational pathways via secondary school placement and limits the role that personality plays in helping adolescents achieve educational success. The role of personality is particularly limited after students have chosen which type of secondary degree to earn. Furthermore, personality is not an important mechanism in the intergenerational transmission of education in Germany. These findings support conceptions of social closure, and the idea that personality plays a more limited role in highly structured systems such as the German educational system. This study contributes to a comprehensive perspective on the role of the adolescent period within the larger life course (Kirkpatrick Johnson et al. 2011) by linking youth's social background, personal characteristics, and earlier educational achievements to later educational outcomes. The study

broadens the scope of current research on non-cognitive skills and the role they play in adolescent lives by using a life course framework to illustrate the importance of both institutional structures and the changing importance of these skills at different points in the life course. Future research on the importance of personal characteristics in adolescent development should take into account institutional structures that may constrain (or enable) their expression in different circumstances.

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**Author Contributions** R.R. conceived of the study, participated in its design and coordination, cleaned the data, participated in the interpretation of the data, and helped draft the manuscript; S.B. participated in study design, performed the statistical analysis, participated in the interpretation of the data, and helped draft the manuscript; M.Sc. participated in the study design, participated in the interpretation of the data, and helped draft the manuscript; A.S. participated in the interpretation of the data and helped draft the manuscript; M.Sh. conceived of the study, participated in its design, and drafted sections of the manuscript. All authors read and approved the final manuscript.

## Compliance with Ethical Standards

**Conflict of Interest** The authors declare that they have no competing interests.

**Ethical Approval** This study was approved by the University of North Carolina at Chapel Hill's Institutional Review Board (15–3192). All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

**Informed Consent** Informed consent was obtained from all individual participants included in the study by the German SOEP team.

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