Original Article

Conscientiousness Is the Most Powerful Noncognitive Predictor of School Achievement in Adolescents

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Abstract. Much research has demonstrated that intelligence and conscientiousness have a high impact on individual school achievement. To figure out if other noncognitive traits have incremental validity over intelligence and conscientiousness, we conducted a study on 498 eighth-grade students from general secondary schools in Austria. Hierarchical regressions for three criteria (GPA, science, and languages) were performed, including intelligence, the Big Five, self-discipline, grit, self-efficacy, intrinsic-extrinsic motivation, and test anxiety. Intelligence and conscientiousness alone accounted for approximately 40% in the variance of school achievement. For languages and GPA, no other personality and motivational predictors could explain additional variance; in science subjects, only self-discipline added incremental variance. We conclude that – in addition to intelligence as powerful cognitive predictor – conscientiousness is *the* crucial noncognitive predictor for school achievement and should be focused on when supporting students in improving their performance.

Keywords: school achievement, intelligence, Big Five, motivation, anxiety

Individual academic achievement in adolescents is determined by various factors. Across different studies, one of the most important predictors is intelligence. Depending on the measure used, the average correlation between intelligence and school grades is about 0.5 (cf. Gustafsson & Undheim, 1996; Laidra, Pullmann, & Allik, 2007). Some studies show even higher relationships; in a 5-year prospective longitudinal study of about 70.000 English children (Deary, Strand, Smith, & Fernandes, 2007), a correlation of 0.81 between the *g* factor of intelligence and a latent trait of educational achievement was observed. Especially in lower grades and nonselective comprehensive schools, intelligence explains the largest amount of variance in school achievement. At higher levels of education, such as the tertiary educational system (college, university), intelligence is not as important anymore in the prediction of achievement (Chamorro-Premuzic & Furnham, 2005; Jensen, 1980). This might go back to the restriction of range because intelligence has already served as selection criterion for the admission to the higher educational track (Boekaerts, 1995).

Intelligence generally seems to be more important for achievement in science subjects than in languages. In science, logical analysis plays a great role, whereas in arts, especially in languages, traits like social confidence are essential (Furnham, Rinaldelli-Tabaton, & Chamorro-Premuzic, 2011).

Even if intelligence is doubtlessly an important factor, there are many other variables which should be considered in the prediction of school achievement. Especially when it comes to educational consulting, it is important to focus not only on the rather unmalleable trait intelligence, but also on intrapersonal strengths like personality and motivational variables. Noncognitive variables might be easier to train and more sensitive to intervention (Stankov, Lee, Luo, & Hogan, 2012). One of the central noncognitive variables to predict school achievement is conscientiousness. In a meta-analysis it has been shown that conscientiousness is the most consistent and stable personality predictor for academic achievement (Poropat, 2009). It combines various traits which are crucial for successful learning: for example, self-discipline, ambition, persistence, diligence, and dutifulness. The narrow traits of conscientiousness can predict academic achievement better than the broad trait (Paunonen & Ashton, 2001). Duckworth and Seligman (2005) found out that self-discipline accounted for more than twice as much variance as intelligence in school achievement and learning behavior of eighth-grade students. However, this result could be partly due to the fact that the study was conducted in a selective school and the consequential range restriction of intelligence.

A conceptually related trait, which has lately been researched, is *grit*, defined as the "perseverance and passion for long-term-goals" (Duckworth, Peterson, Matthews, & Kelly, 2007, p. 1). Grit integrates aspects of achievement striving, self-control, and consistency of interests and encourages the realization of existing talents in an individual. Duckworth et al. (2007) conducted several studies in

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high-achieving persons and found out that grit was related to educational attainment and career stability.

Openness and related traits, such as *Typical Intellectual Engagement* or *Intellectual Curiosity*, have also turned out to be important for academic achievement. Students who enjoy spending time with cognitively demanding tasks are more likely to perform well in school (Goff & Ackerman, 1992; Poropat, 2009; von Stumm, Hell, & Chamorro-Premuzic, 2011). On the other hand, extraversion turned out as a trait whose impact on academic achievement changes with age. While extraversion might be beneficial for school performance in earlier years of formal education, in higher levels of education it is negatively correlated with grades. This could be traced back to the changing – from social to formal – character of school across different levels of education (O'Connor & Paunonen, 2007). A similar pattern is found for agreeableness: in primary school, it seems to have relatively high impact on achievement, whereas it does not play a role in later years of education (Laidra et al., 2007).

Most studies have found a negative relation between neuroticism and academic achievement (Poropat, 2009). If a student is very anxious, this might interfere with his attention to academic tasks and lead to poorer performance (De Raad & Schouwenburg, 1996). A trait which specifically addresses this issue is *test anxiety*. It has been shown that test anxiety is negatively correlated with academic achievement at different educational levels (Hembree, 1988; Rindermann & Neubauer, 2001).

In addition to the discussed personality traits, we also considered motivational variables like self-efficacy and intrinsic versus extrinsic school motivation. Self-efficacy is defined as "beliefs in one's capabilities to mobilize the motivation, cognitive resources, and courses of action needed to meet given situational demands" (Wood & Bandura, 1989, p. 408). This trait plays a role in various life areas; among others, it is associated with job search success (Saks, 2006), career success (Abele & Spurk, 2009), and academic achievement (Caprara, Vecchione, Alessandri, & Barbaranelli, 2011). Intrinsic-extrinsic motivation is described in the framework of Deci and Ryan's (1985) self-determination theory. According to this theory, motivation is not only two-dimensional, but extrinsic motivation can be divided again into the components *external regulation*, *introjected regulation*, and *identified regulation*. Intrinsic regulation represents the highest level of self-determination, external regulation the lowest. Self-determined motivation turned out to be positively related to educational outcomes (Deci, Vallerand, Pelletier, & Ryan, 1991).

Most studies on the prediction of academic achievement can be found in higher education (cf. Poropat, 2009). But if we want to support students early in improving their achievement to open them new possibilities for future career, more research in earlier years of education is needed. In the present study, we include all of the described variables to find the best set of predictors for the school achievement of 13–14-year-old adolescents. In contrast to most of the studies mentioned above, which only focus on certain personality or motivational traits, our aim was to consider almost all variables that are often examined in the context of school achievement. It could be possible that some of the discussed variables turn out as redundant when simultaneously assessed with other (similar) traits.[1]

We did not only include various predictors of school achievement simultaneously, but also examined their impact on different criteria of school achievement, namely GPA, and science versus languages. In this, we tested the predictive power of the broad personality traits of the big five but, additionally, also whether the – in this context most relevant narrow personality traits – allow for an incremental prediction of the various school achievement indicators. The results of this study should allow us to conclude which personality and motivational traits are most important for students who want to improve their achievement and should, therefore, be assessed in counseling contexts.

First, the relationships between school achievement and the selected personality and motivational variables shall be studied. Based on previous findings, we expect substantial relationships of the broad big five factors conscientiousness and openness with school achievement (Laidra et al., 2007; Poropat, 2009). Furthermore, we assume relationships with the narrow traits self-discipline, grit, test anxiety, self-efficacy, and intrinsic (versus extrinsic) motivation (Caprara et al., 2011; Deci et al., 1991; Duckworth et al., 2007; Duckworth & Seligman, 2005; Hembree, 1988).

Second, the relative importance of the personality and motivation predictors compared to intelligence should be examined. Due to the characteristics of our sample that is not restricted in intellectual range, intelligence should have the highest impact on school achievement (Chamorro-Premuzic & Furnham, 2005; Jensen, 1980). In this, we will also explore the question if any of the selected personality and motivational variables shows incremental validity above the hitherto most potent noncognitive predictor of school achievement, that is, conscientiousness. On the basis of the findings of Paunonen and Ashton (2001) as well as Lounsbury, Sundstrom, Loveland, and Gibson (2003) we expect all narrow traits to potentially improve the prediction.

Third, similarities and discrepancies in the prediction of different criteria of school achievement – *grade point average* (*GPA*), *science*, and *languages* – shall be assessed. Based on the findings of Furnham et al. (2011), intelligence should be most important for science, whereas personality and motivational traits should be most important for languages.

[1] Due to economic reasons, we could not include each relevant construct. In smaller pilot studies we found out that, for example, typical intellectual engagement could not predict school achievement in a sample of average-achieving adolescents. Therefore, this trait was omitted for the main study presented here.

Method

Participants

We tested 498 students from general secondary schools. This school track is more work-oriented (in contrast to academic secondary schools that prepare for university) and attended by approximately two-thirds of Austrian adolescents (Freudenthaler, Spinath, & Neubauer, 2008). General secondary schools are open for all children independent of previous school achievement. Due to incomplete data regarding school grades, 137 persons had to be excluded from the present analyses. The final sample consisted of 171 girls and 190 boys with a mean age of 14.09 years (SD = 0.48). All students participated voluntarily with informed consent of their parents. Cognitive abilities were tested at the end of seventh grade under supervision of trained testers whereas all other measures were taken a few months later (under supervision of specially trained teachers).

While school achievement, intelligence, the Big Five, self-discipline, and self-efficacy were assessed in the entire sample, the remaining personality and motivational variables were only tested within smaller subsamples. Grit was measured in a sample of 129 persons (78 girls), test anxiety in a sample of 131 persons (49 girls), and intrinsic-extrinsic motivation in a sample of 94 persons (40 girls).

Measures and Procedure

To obtain a measure for school achievement, students were asked to report all grades of their last certificate (end of 7th grade). For the *GPA*, we computed a weighted mean score consisting of following grades: German, English, Math, Physics, Biology, Geography, and History. German, English, and Math were double-weighted as the curriculum demands twice as many credit hours for these subjects. For obtaining a measure of science, a weighted mean score consisting of Biology, Physics, and Math (with a double weight on math) was computed. For languages, the mean of German and English was computed.

For intelligence, three subscales of the German test "Intelligenz-Struktur-Analyse" (ISA; Blum et al., 1998) were used (verbal intelligence: "Gemeinsamkeiten finden" – commonalities; numeric intelligence: "Zahlenreihen fortsetzen" – number series; visuospatial intelligence: "Figuren zusammensetzen" – composition of figures). The time-restricted subscales comprise 20 items each and show internal consistencies between .80 and .89. An EFA of the subscales indicated a first unrotated factor with an eigenvalue of 1.78 accounting for 41% of the variance. For obtaining a measure of general intelligence, the factor scores for the first unrotated factor were used for further analyses.

To assess the Big Five, the German version of the Hierarchical Personality Inventory for Children (HiPIC; Mervielde & De Fruyt, 2002; German version by Bleidorn & Ostendorf, 2009) was used. It comprises 144 items on five factors, namely *Neuroticism* (*N*), *Extraversion* (*E*), *Imagination* (*I*), *Benevolence* (*B*), and *Conscientiousness* (*C*), on a 5-point Likert-type scale (responses range from *barely characteristic of me* to *highly characteristic of me*). The factors I and B can be regarded as equivalent to the Big Five factors openness and agreeableness. The inventory shows high reliabilities (α = .83–.88) in adolescents.

For measuring self-discipline and general self-efficacy, new scales were developed that should be better suited for the target sample of 13-year-olds, because the existing questionnaires seem too difficult in verbal formulations to be understood by 13-year-old students encompassing the full range of verbal abilities. To generate the new items, we extracted contents from well-established questionnaires measuring related traits (e.g., NEO-PI-R; Costa & McCrae, 1992; HEXACO-PI-R; Lee & Ashton, 2004; Self-Control Scale; Tangney, Baumeister, & Boone, 2004; general self-efficacy [Allgemeine Selbstwirksamkeitserwartung]; Jerusalem & Satow, 1999) and reformulated the contents in much simpler ways than in the classical questionnaires that are targeted at adult persons. To ensure that the new items are adequate for our adolescent sample, we conducted cognitive interviews with the students as well as pilot studies.

In their final versions, the self-discipline scale was comprised of six items, the self-efficacy scale of seven items. We used a 4-point Likert-type scale ranging from *not appropriate* to *very appropriate*. The results of the confirmatory factor analyses indicated one-dimensionality for each scale (self-discipline: $\chi^2_{(df = 9)} = 25.17$, p (Bollen-Stine Bootstrap) = .040; RMSEA = .048, CFI = .97, SRMR = .029; self-efficacy: $\chi^2_{(df = 14)} = 31.22$, p (Bollen-Stine Bootstrap) = .040; RMSEA = .040, CFI = .98, SRMR = .040). The internal consistencies (for the present sample) are acceptable (self-discipline: α = .63; self-efficacy: α = .72). The validity of the new scales had been tested in pilot studies. For self-discipline, construct validity was demonstrated by high correlations with the facet scales concentration (r = .55) and perseverance (r = .60) of the Big Five factor conscientiousness (assessed using the HiPIC; Mervielde & De Fruyt, 2002), as well as by either low or moderate correlations with the other HiPIC factors (neuroticism: r = −.34, extraversion: r = .12, imagination: r = .25, benevolence: r = .41) and intrinsic motivation (r = .31; measured by the Academic Self-Regulation Questionnaire *SRQ-A*; Ryan & Connell, 1989; German version by Müller, Hanfstingl, & Andreitz, 2007). Criterion validity could be shown by positive relationships with time spent on learning (r = .12), time of day when homework is begun (r = −.27) and negative relationships with watching TV (r = −.14) and playing computer games (r = −.21; measured by asking for the weekly time amount spent on certain activities). For self-efficacy, we found relationships which were similar to those of the self-efficacy scale by Jerusalem and Satow (1999), for example, high negative relationships with the HiPIC factor neuroticism (r = −.50) and the scale *lack of confidence* of the *Test-Anxiety Questionnaire PAF* (r = −.54; "Prüfungsangstfragebogen"; Hodapp, Rohrmann, & Ringeisen, 2011).

Table 1. Descriptive statistics and correlations among the variables

	N	*M*	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Sex	361	–	–	–												
2. Age	358	14.09	0.48	.01	–											
3. *GPA*	327	3.59	0.90	−.14*	−.16**	–										
4. *Science*	361	3.60	0.91	−.09	−.15**	.94**	–									
5. *Lang*	339	3.39	1.01	−.15**	−.18**	.92**	.76**	–								
6. IQ	361	0.00	0.85	.18**	−.14*	.55**	.56**	.46**	–							
7. C	359	3.40	0.48	−.02	−.03	.34**	.31**	.28**	.16**	–						
8. N	357	2.65	0.58	−.28**	.03	−.16**	−.14**	−.13*	−.28**	−.37**	–					
9. E	358	3.36	0.47	−.21**	−.07	.18**	.11*	.18**	.10*	.31**	−.26**	–				
10. I	359	3.41	0.51	−.08	−.02	.31**	.27**	.29**	.28**	.54**	−.33**	.57**	–			
11. B	357	3.41	0.39	−.25**	−.04	.19**	.20**	.14*	.00	.40**	−.17**	.16**	.19**	–		
12. Self-d	360	7.08	1.39	−.05	.00	.23**	.25**	.13*	.04	.59**	−.34**	.12*	.25**	.41**	–	
13. Self-e	358	20.19	3.20	.08	−.02	.23**	.22**	.17**	.24**	.47**	−.50**	.34**	.53**	.20**	.32**	–
14. Grit	129	19.04	3.37	.09	.05	.29**	.20*	.23*	.15	.67**	−.54**	.21*	.39**	.39**	.67**	.61**
15. TA	131	45.66	7.75	−.21*	.05	−.14	−.19*	−.08	−.29**	−.24**	.65**	−.05	−.14	−.05	−.12	−.28**
16. SDI	94	10.64	11.03	−.18	−.30**	.19	.22*	.12	−.05	.40**	−.32**	.14	.16	.28**	.43**	.29**

Notes. lang = languages; self-d = self-discipline; self-e = self-efficacy; TA = test anxiety; female = 1, male = 2. *$p < .05$. **$p < .01$ (two-tailed). Variables 14–16 could not be correlated because of non-overlapping samples.

To assess grit, the Short-Grit-Scale (Duckworth & Quinn, 2009), which consists of eight items, was translated into German. We used a 4-point Likert-type scale ranging from *not appropriate* to *very appropriate*. The internal consistency in our sample was sufficient ($\alpha = .70$, $N = 129$).

Test anxiety was measured by the German test-anxiety questionnaire PAF (Hodapp et al., 2011). The questionnaire comprises of 20 items and shows high internal consistency ($\alpha = .82$–$.90$).

Intrinsic-extrinsic motivation was assessed by a German adaptation of the SRQ-A (Ryan & Connell, 1989). It consists of 17 items on four scales: *intrinsic*, *identified*, *introjected*, and *external regulation* on a 5-point Likert-type scale ranging from *very appropriate* to *not appropriate*. The items are originally formulated to refer to only one school subject, but were used here to assess general scholastic motivation (e.g., "I mainly learn or study in school because it's fun"). The internal consistencies for the German version are satisfying ($\alpha = .67$–$.90$). The self-determination index (*SDI*) is computed as suggested by the authors using the following formula: 2 × intrinsic + identified − introjected − 2 × external.

Results

Descriptive statistics as well as correlations among the variables can be seen in Table 1. GPA as a composite of the other two criteria is – of course – highly correlated with them; interesting is only that science and languages still shared 58% of variance. Gender was slightly associated with GPA and languages (girls performed better). Age was slightly negatively correlated with all criteria. Intelligence was highly related to school achievement, especially with GPA and science, somewhat lower with languages. The correlations between the Big Five factors and school achievement were rather similar for the three criteria; conscientiousness and imagination were moderately, extraversion and benevolence slightly correlated with school achievement. Neuroticism was slightly negatively associated with school achievement. Grit and self-efficacy were slightly to moderately positively associated with the criteria. Test anxiety and intrinsic-extrinsic motivation were only slightly related to science, but not to GPA and languages.

To examine the relative importance of all personality and motivational predictors, we performed hierarchical regressions for all criteria. All regressions had the same structure; to control for sex and age, these variables were introduced in the first step. Due to the hypothesis that intelligence and conscientiousness are the most important predictor variables, they were included in the second step. In the third step, additional personality or motivational predictors were included to assess incremental variance of these variables. Since grit, test anxiety, and intrinsic-extrinsic motivation were not tested within the entire sample, but each of them within a subsample, not all predictors could be entered in one regression. To examine if the subsamples for grit, extrinsic-intrinsic motivation, and test anxiety are comparable to the larger sample, we performed the main regression analyses (regressions 1a–c) again within the subsamples. The results deviated only marginally with respect to the beta weights, only some of them did no longer reach significance, which could be explained by the decreasing statistical power of smaller samples.

The results, summarizing total R^2 after step 1 and R^2 change after step 2, as well as the regression coefficients of the final model, can be found in Tables 2–4. In none of the regression analyses, the predictor variables showed multicollinearity. The final regression models of the entire

Table 2. Regressions 1a-c (r1a-r1c): Predicting school achievement by age, gender (step 1), intelligence, conscientiousness (step 2), the remaining Big Five, self-discipline, and self-efficacy (step 3)

	GPA (r1a, $N = 318$)				Science (r1b, $N = 351$)				Languages (r1c, $N = 330$)			
	R^2	ΔR^2	β	t	R^2	ΔR^2	β	t	R^2	ΔR^2	β	t
Step 1	.05				.03				.06			
		$F(2, 315) = 8.18^{**}$				$F(2, 348) = 6.07^{**}$				$F(2, 327) = 10.34^{**}$		
Step 2	.44	.39			.41	.38			.32	.26		
		$\Delta F(2, 313) = 107.48^{**}$				$\Delta F(2, 346) = 110.18^{**}$				$\Delta F(2, 325) = 62.05^{**}$		
Step 3	.45	.01			.43	.02			.32	.00		
		$\Delta F(6, 307) = 0.80$				$\Delta F(6, 340) = 2.19^{*}$				$\Delta F(6, 316) = 0.22$		
Sex			−.21	−4.31**			−.15	−3.26**			−.22	−4.07**
Age			−.09	−2.16*			−.08	−1.85			−.13	−2.67**
IQ			.56	12.06**			.58	12.91**			.44	8.70**
C			.18	2.85**			.15	2.50*			.19	2.77**
N			.06	1.09			.10	1.80			.01	0.24
E			.00	0.08			−.05	−0.89			.01	0.08
I			.01	0.20			−.00	−0.05			.06	0.89
B			.04	0.88			.06	1.33			.01	0.25
Self-d			.09	1.63			.13	2.30*			−.01	−0.21
Self-e			.02	0.29			.04	0.66			.02	−0.44

Notes. self-d = self-discipline; self-e = self-efficacy. $^{*}p < .05$. $^{**}p < .01$ (two-tailed).

sample (regressions 1a–c; Table 2) accounted for 45% of the variance in GPA and for 32% of the variance in languages. In the prediction of GPA and languages, only steps 1 and 2 (IQ, C) contributed significantly. The remaining Big Five factors, as well as self-discipline and self-efficacy (step 3), did not explain incremental variance. Intelligence was the strongest predictor, explaining 26% of unique variance in GPA and 16% in languages. Only in science, one of the step 3 variables (self-discipline) could marginally enhance the prediction, uniquely explaining 1% of the variance. Intelligence was the strongest predictor, explaining 34% of unique variance.

In subsample 1 (regressions 2a–c; Table 3), the incremental contribution of grit over and above intelligence and conscientiousness was examined. Similar to the findings of the full sample, the amount of prediction could only be increased significantly in steps 1 and 2. Adding grit in the third step could not enhance the prediction, either for GPA, or for science or languages.

Due to nonsignificant zero-order correlations between the predictors test anxiety and intrinsic-extrinsic motivation with the criteria GPA and languages, regressions for these traits were only performed for science. In subsample 2 (regression 3; Table 4), we analyzed the incremental variance of test anxiety by adding it in the third step. It could not increase the amount of prediction. In subsample 3 (regression 4; Table 4), intrinsic-extrinsic motivation was entered in the third step of the regression and could also not account for incremental variance.[2]

Discussion

We examined the impact of specific personality and motivational predictors on the school achievement of eighth-graders comparing three criteria: GPA (average across all subjects), science subjects, and language subjects.

First, we deal with the bivariate correlations between school achievement and all personality and motivational predictors: The correlation between intelligence and school achievement was high; compared to previous findings (Furnham et al., 2011) it was considerably higher with science than with languages. Although the three criterion variables were strongly intercorrelated, we found different patterns of correlates with personality and motivational traits. All Big Five traits as well as grit and self-efficacy showed the highest associations with GPA. This could easily be explained by the presumed higher reliability of this criterion compared to the others due to the higher level of aggregation. By contrast, two of the narrow traits, namely test anxiety and intrinsic-extrinsic motivation, correlated significantly only with science. Comparable results could be found in Spinath, Freudenthaler, and Neubauer (2010): neuroticism showed incremental validity over intelligence and ability self-perceptions only in Math achievement, not in languages. Steinmayr and Spinath (2007) obtained similar results and conjectured that test anxiety seems to be more important in domains where the correctness of answers can be logically determined more easily, as it is the case with Math. These findings could be interpreted in a

[2] All regression analyses were repeated entering the narrow traits (self-discipline, self-efficacy, grit, test anxiety, and intrinsic-extrinsic motivation) in the second step and conscientiousness in the third step. The results indicated significant contributions of all narrow traits in the second step which were reduced to nonsignificance when adding conscientiousness in the following step. Conscientiousness accounted for incremental variance over and above the narrow traits (for space constraints these results are not presented here but can be obtained from the authors).

Table 3. Regressions 2a–c (r2a–r2c): Predicting school achievement in subsample 1 by age, gender (step 1), intelligence, conscientiousness (step 2), and Grit (step 3)

	GPA (r2a, $N = 107$)				Science (r2b, $N = 126$)				Languages (r2c, $N = 114$)			
	R^2	ΔR^2	β	t	R^2	ΔR^2	β	t	R^2	ΔR^2	β	t
Step 1	.08				.08				.09			
		$F(2, 104) = 4.25^{**}$				$F(2, 123) = 5.10^{**}$				$F(2, 111) = 5.75^{**}$		
Step 2	.48	.41			.44	.36			.40	.30		
		$\Delta F(2, 102) = 40.23^{**}$				$\Delta F(2, 121) = 39.16^{**}$				$\Delta F(2, 109) = 27.39^{**}$		
Step 3	.49	.00			.44	.00			.40	.00		
		$\Delta F(1, 101) = 0.55$				$\Delta F(1, 120) = 0.02$				$\Delta F(1, 108) = 0.43$		
Sex			−.21	−2.80**			−.11	−1.63			−.25	−3.34**
Age			−.15	−1.97			−.16	−2.22*			−.17	−2.16*
IQ			.53	6.76**			.53	7.04**			.47	5.74**
C			.23	2.20**			.21	2.25*			.17	1.57
Grit			.08	0.74			.01	0.14			.07	0.65

Note. $^{*}p < .05$. $^{**}p < .01$ (two-tailed).

way that strategies to encourage the intrinsic motivation and reduce the test anxiety of students are of particular importance in Math, maybe generally in science subjects.

Most bivariate correlations between school achievement and the predictor variables correspond to previous findings (Chamorro-Premuzic & Furnham, 2005; De Raad & Schouwenburg, 1996; Poropat, 2009): moderate relations with conscientiousness, imagination (openness), self-discipline, grit, and self-efficacy as well as weak relations with benevolence (agreeableness), test anxiety, and intrinsic-extrinsic motivation. Contrary to previous findings, extraversion was also slightly positively correlated with school achievement, especially with GPA and languages. Spinath et al. (2010) obtained similar results in eighth-graders (but only in girls) which they explained by the higher importance of oral performance in languages. If participating actively during class is requested, extraverted students may have advantages in these subjects.

The hierarchical regressions indicated that all selected predictors together explained almost half of the variance in adolescent school achievement. Intelligence was by far the most important predictor; although conscientiousness could uniquely contribute to the prediction, the impact of intelligence was much higher. This result is comparable to findings of studies in similar populations; in nonselective schools where intelligence is not (yet) range-restricted (Freudenthaler et al., 2008; Laidra et al., 2007).

With respect to the GPA and languages, girls performed significantly better than boys while there was no difference in sciences. This is in line with previous findings (Freudenthaler et al., 2008). Age had a negative impact on school achievement. This may seem counterintuitive, but it can be explained by the fact that all students were basically from the same age cohort; most students who were older than the average have likely repeated at least one grade because of poor performance.

Although most bivariate correlations were as high as expected on the basis of the literature, the third step of the hierarchical regressions showed that – in addition to conscientiousness – no other personality or motivational traits could substantially enhance the prediction. Self-discipline could account for only 1% of incremental

Table 4. Regressions 3 and 4 (r3, r4): Predicting *Science* by age, gender (step 1), intelligence, conscientiousness (step 2), and test anxiety (step 3; subsample 2), respectively, intrinsic-extrinsic motivation (step 3; subsample 3)

	Science (r3, $N = 94$)					Science (r4, $N = 130$)			
	R^2	ΔR^2	β	t		R^2	ΔR^2	β	t
Step 1	.05				Step 1	.00			
		$F(2, 127) = 3.23^{**}$					$F(2, 91) = 0.03$		
Step 2	.49	.44			Step 2	.29	.28		
		$\Delta F(2, 125) = 53.59^{**}$					$\Delta F(2, 89) = 17.67^{**}$		
Step 3	.49	.00			Step 3	.31	.02		
		$\Delta F(1, 124) = 0.03$					$\Delta F(1, 88) = 3.03$		
Sex			−0.25	−3.78**	Sex			−0.09	−0.94
Age			0.01	0.08	Age			0.05	0.55
IQ			0.63	9.04**	IQ			0.48	5.19**
C			0.26	3.92**	C			0.15	1.49
Test anxiety			0.01	0.18	*SDI*			0.18	1.74

Note. $^{**}p < .01$ (two-tailed).

variance over intelligence and conscientiousness in the prediction of science; none of the narrow traits could enhance the prediction of GPA or languages. Broad traits could substantially improve the prediction over and above narrow traits, but not vice versa. That implies that in this age range tested here there seems to be little benefit of assessing narrow traits like self-discipline or grit for counseling contexts. For the target population of average-achieving adolescents it would be sufficient to examine broad personality traits, particularly conscientiousness, when supporting them in improving school achievement. The narrower traits might be of relevance in higher age ranges or more selective schools like academic high schools. It may also be possible that the broad traits outperformed the narrow traits because of the broad performance criteria used in this study. It has been shown that narrow traits are useful when predicting specific performance criterion, as for instance, counterproductive work behaviors. However, when predicting a global criteria, like overall job performance, broad traits are preferable (Ones & Viswesvaran, 1996; Dudley, Orvis, Lebiecki, & Cortina, 2006). Therefore, it would be interesting to extend our study to additional performance criteria in school, for example, class participation or oral exam performance.

In summary, intelligence and conscientiousness turned out – once again – as the most powerful predictors for school achievement of adolescents. No other personality and motivational variables (the remaining Big Five, self-discipline, grit, self-efficacy, intrinsic-extrinsic motivation, and test anxiety) could substantially enhance the prediction, although most of them were correlated with grades.

As a restriction of our study it should be mentioned that on the basis of a thorough literature research we included only the most discussed variables with respect to the prediction of school achievement. Due to economic reasons, we could not test each variable which has turned out to be associated with school achievement but focused on those which turned out to be of importance in samples of comparable age ranges and school types. For future directions, it would be interesting to explore the impact of certain other constructs over and above personality and motivation. For example, it would be interesting to also include approaches to learning. Previous research demonstrated interactions between personality traits and approaches to learning regarding academic achievement (Diseth, 2003).

Based on our results, we conclude that conscientiousness is *the* crucial noncognitive trait in school achievement of adolescents. Some authors suggest that high conscientiousness can even compensate for low (fluid) intelligence; that is, students with lower intelligence and high conscientiousness could perform as well as their more intelligent colleagues who do not show such structured and persevering learning habits (Moutafi, Furnham, & Paltiel, 2004; Wood & Englert, 2009). So it might be useful to focus on the impact of conscientiousness in improving school achievement, for example, for school career counselors. Some conscientious behaviors – like being on time, tidying up the workplace, or keeping focused on a task – can be trained with little effort but might have considerable influence on school achievement.

References

Abele, A. E., & Spurk, D. (2009). The longitudinal impact of self-efficacy and career goals on objective and subjective career success. *Journal of Vocational Behavior, 74*, 53–62.

Bleidorn, W., & Ostendorf, F. (2009). Ein Big Five-Inventar für Kinder und Jugendliche. Die deutsche Version des Hierarchical Personality Inventory for Children (HiPIC) [A Big Five inventory for children and adolescents: The German version of the Hierarchical Personality Inventory for Children (HiPIC)]. *Diagnostica, 55*, 160–173.

Blum, F., Didi, H. J., Fay, E., Maichle, U., Trost, G., Wahlen, J. H., & Gittler, G. (1998). *Intelligenz Struktur Analyse (ISA). Ein Test zur Messung der Intelligenz* [Intelligence Structure Analysis. A test for measuring intelligence]. Frankfurt, Germany: Swets & Zeitlinger B. V., Swets Test Services.

Boekaerts, M. (1995). The interface between intelligence and personality as determinants of classroom learning. In D. H. Saklofske & M. Zeidner (Eds.), *Handbook of Personality and Intelligence* (pp. 161–183). New York, NY: Plenum.

Caprara, G. V., Vecchione, M., Alessandri, M. G., & Barbaranelli, C. (2011). The contribution of personality traits and self-efficacy beliefs to academic achievement: A longitudinal study. *The British Journal of Educational Psychology, 81*, 78–96.

Chamorro-Premuzic, T., & Furnham, A. (2005). *Personality and intellectual competences*. Mahwah, NJ: Erlbaum.

Costa, P. T. Jr., & McCrae, R. R. (1992). *Revised NEO personality inventory (NEO-PI-R) and NEO five-factor inventory (NEO-FFI): Professional manual*. Odessa, FL: Psychological Assessment Resources.

Deary, I. J., Strand, S., Smith, P., & Fernandes, C. (2007). Intelligence and educational achievement. *Intelligence, 35*, 13–21.

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. New York, NY: Plenum.

Deci, E. L., Vallerand, R. J., Pelletier, L. G., & Ryan, R. M. (1991). Motivation and education: The self-determination perspective. *The Educational Psychologist, 26*, 325–346.

De Raad, B., & Schouwenburg, H. (1996). Personality in learning and education: A review. *European Journal of Personality, 10*, 406–425.

Diseth, Å. (2003). Personality and approaches to learning as predictors of academic achievement. *European Journal of Personality, 17*, 143–156.

Duckworth, A. L., Peterson, C., Matthews, M. D., & Kelly, D. R. (2007). Grit: Perseverance and passion for long-term goals. *Journal of Personality & Social Psychology, 92*, 1087–1101.

Duckworth, A. L., & Quinn, P. D. (2009). Development and validation of the Short Grit Scale (GRIT–S). *Journal of Personality Assessment, 91*, 166–174.

Duckworth, A. L., & Seligman, M. E. P. (2005). Self-discipline outdoes IQ in predicting academic performance of adolescents. *Psychological Science, 16*, 939–944.

Dudley, N. M., Orvis, K. A., Lebiecki, J. E., & Cortina, J. M. (2006). A meta-analytic investigation of conscientiousness in the prediction of job performance: Examining the intercorrelations and the incremental validity of narrow traits. *Journal of Applied Psychology, 91*, 40.

Freudenthaler, H. H., Spinath, B., & Neubauer, A. C. (2008). Predicting school achievement in boys and girls. *European Journal of Personality, 22*, 231–245.

Furnham, A., Rinaldelli-Tabaton, E., & Chamorro-Premuzic, T. (2011). Personality and intelligence predict arts and science school results in 16 year olds. *Psychologia, 54*, 39–51.

Goff, M., & Ackerman, P. L. (1992). Personality-intelligence relations: Assessment of typical intellectual engagement. *Journal of Educational Psychology, 84*, 537–552.

Gustafsson, J.-E., & Undheim, J. O. (1996). Individual differences in cognitive functions. In D. C. Berliner & R. C. Calfee (Eds.), *Handbook of educational psychology* (pp. 186–242). New York, NY: Prentice Hall.

Hembree, R. (1988). Correlates, causes, effects, and treatment of test anxiety. *Review of Educational Research, 58*, 47–77.

Hodapp, V., Rohrmann, S., & Ringeisen, T. (2011). *PAF – Prüfungsangstfragebogen* [Test anxiety questionnaire]. Göttingen, Germany: Hogrefe.

Jensen, A. R. (1980). *Bias in mental testing*. New York, NY: The Free Press.

Jerusalem, M., & Satow, L. (1999). Schulbezogene Selbstwirksamkeitserwartung [School-related self-efficacy]. In R. Schwarzer & M. Jerusalem (Eds.), *Skalen zur Erfassung von Lehrer- und Schülermerkmalen* (pp. 15–16). Berlin, Germany: Freie Universität Berlin.

Laidra, K., Pullmann, H., & Allik, J. (2007). Personality and intelligence as predictors of academic achievement: A cross-sectional study from elementary to secondary school. *Personality and Individual Differences, 42*, 441–451.

Lee, K., & Ashton, M. C. (2004). Psychometric properties of the HEXACO personality inventory. *Multivariate Behavioral Research, 39*, 329–358.

Lounsbury, J. W., Sundstrom, E., Loveland, J. L., & Gibson, L. W. (2003). Broad versus narrow personality traits in predicting academic performance of adolescents. *Learning and Individual Differences, 14*, 65–75.

Mervielde, I., & De Fruyt, F. (2002). Assessing children's traits with the Hierarchical personality inventory for children. In B. De Raad & M. Perugini (Eds.), *Big Five assessment* (pp. 129–142). Göttingen, Germany: Hogrefe.

Moutafi, J., Furnham, A., & Paltiel, L. (2004). Why is conscientiousness negatively correlated with intelligence? *Personality and Individual Differences, 37*, 1013–1022.

Müller, F. H., Hanfstingl, B., & Andreitz, I. (2007). *Skalen zur motivationalen Regulation beim Lernen von Schülerinnen und Schülern: Adaptierte und ergänzte Version des Academic Self-Regulation Questionnaire (SRQ-A) nach Ryan & Connell* [Scales to assess motivational regulation during students' learning]. Wissenschaftliche Beiträge aus dem Institut für Unterrichts- und Schulentwicklung Nr. 1. Klagenfurt: Alpen-Adria-Universität.

O'Connor, M. C., & Paunonen, S. V. (2007). Big Five personality predictors of postsecondary academic performance. *Personality and Individual Differences, 43*, 971–990.

Ones, D. S., & Viswesvaran, C. (1996). Bandwidth-fidelity dilemma in personality measurement for personnel selection. *Journal of Organizational Behavior, 17*, 609–626.

Paunonen, S. V., & Ashton, M. C. (2001). Big Five predictors of academic achievement. *Journal of Research in Personality, 35*, 78–90.

Poropat, A. E. (2009). A meta-analysis of the five-factor model of personality and academic performance. *Psychological Bulletin, 135*, 322–338.

Rindermann, H., & Neubauer, A. C. (2001). The influence of personality on three aspects of cognitive performance: Processing speed, intelligence and school performance. *Personality and Individual Differences, 30*, 829–842.

Ryan, R. M., & Connell, J. P. (1989). Perceived locus of causality and internalization: Examining reasons for acting in two domains. *Journal of Personality and Social Psychology, 57*, 749–761.

Saks, A. M. (2006). Multiple predictors and criteria of job search success. *Journal of Vocational Behavior, 68*, 400–415.

Spinath, B., Freudenthaler, H. H., & Neubauer, A. (2010). Domain-specific school achievement in boys and girls predicted by intelligence, personality and motivation. *Personality and Individual Differences, 48*, 481–486.

Stankov, L., Lee, J., Luo, W., & Hogan, D. J. (2012). Confidence: A better predictor of academic achievement than self-efficacy, self-concept and anxiety? *Learning and Individual Differences, 22*, 747–758.

Steinmayr, R., & Spinath, B. (2007). Predicting School Achievement from Motivation and Personality. *Zeitschrift für Pädagogische Psychologie, 21*, 207–216.

Tangney, J. P., Baumeister, R. F., & Boone, A. L. (2004). High self-control predicts good adjustment, less pathology, better grades, and interpersonal success. *Journal of Personality, 72*, 271–323.

von Stumm, S., Hell, B., & Chamorro-Premuzic, T. (2011). Curiosity predicts academic performance. The hungry mind: Intellectual curiosity as third pillar of academic performance. *Perspectives on Psychological Science, 6*, 574–588.

Wood, P., & Englert, P. (2009). Intelligence compensation theory: A critical examination of the negative relationship between conscientiousness and fluid and crystallised intelligence. *The Australian and New Zealand Journal of Organisational Psychology, 2*, 19–29.

Wood, R., & Bandura, A. (1989). Impact of conceptions of ability on self-regulatory mechanisms and complex decision making. *Journal of Personality and Social Psychology, 56*, 407–415.

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