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Volition and Academic Achievement: Interindividual Differences in Action Control Mediate the Effects of Conscientiousness and Sex on Secondary School Grading

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School achievement is highly predictive of future success. Thus, variables predicting school achievement are of utmost importance. Besides cognitive abilities and personality traits, differences in volition are likely to influence the individual's achievement. This study is the first to analyze the influence of volitional abilities in terms of action control on secondary education grading. Our results indicate that action orientation after failure (AOF) and decision-related action orientation (AOD) are associated with secondary school achievement. Furthermore, a multiple regression analysis revealed that AOF and AOD make unique contributions toward predicting final grade, beyond the effects of such prominent influencing factors as fluid intelligence, conscientiousness, and sex. Remarkably, the predictive value of conscientiousness did not prove to be unique in nature but was mediated by AOD. The same applies for sex differences in academic achievement. Our study reveals that the influence of sex on final grade was mediated by AOF and AOD. In summary, our results suggest that volition is an important predictor of achievement in secondary education. Therefore, we highly recommend including measures of volition into future studies investigating the noncognitive correlates of school achievement.

Keywords: school achievement, action control, fluid intelligence, conscientiousness, sex differences

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School achievement, like secondary education grading, is a major factor when it comes to future academic and professional success (Dust-

mann, 2004). Students with better grades achieve better results at university (Cyrenne & Chan, 2012) and perform better in job-related

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contexts (P. L. Roth, BeVier, Switzer, & Shipmen, 1996). Moreover, better grades are associated with higher salaries (P. L. Roth & Clarke, 1998).

Thus, factors influencing school achievement are of utmost interest to teachers, recruiters, and psychologists. The most frequently studied factor influencing school achievement appears to be cognitive ability (Chamorro-Premuzic, Quiroga, & Colom, 2009). A meta-analysis by B. Roth et al. (2015) reported a significant mean correlation of $r = .54$ between intelligence and school grading. However, some authors emphasize the relevance of noncognitive factors when it comes to predicting school achievement (Poprat, 2009). Such noncognitive factors include the Big Five personality traits—agreeableness, conscientiousness, extraversion, neuroticism, and openness (Nofle & Robins, 2007). Previous research by Dumfart and Neubauer (2016) revealed that conscientiousness in particular is a consistent predictor of school achievement.

Another important factor related to academic achievement is volition. Volition comprises various mechanisms that are needed to obtain a predefined goal (Corno & Kanfer, 1993). Interindividual differences in volition have been explicitly described in Kuhl's action control theory (Kuhl, 1992). The theory specifies psychological processes that execute an intention, defend it from competing alternatives, and inhibit negative thoughts and unwanted negative feelings (Kuhl, Kazén, & Koole, 2006). Kuhl (1992) assumes that individuals differ in their ability to control their actions and classifies them as either action- or state-oriented. He also distinguishes between different situations in which action control is needed (Kuhl, 1994). This leads to three scales of action control: (i) action orientation subsequent to failure versus preoccupation (AOF); (ii) prospective and decision-related action orientation versus hesitation (AOD); and (iii) action orientation during (successful) performance of activities (AOP).

AOF deals with the way an individual handles drawbacks and failures. Action-oriented persons manage to leave negative emotions behind to start something new (Kuhl & Beckmann, 1994), while state-oriented persons remain in the undesirable emotional state and ruminate about the aversive event. Moreover, high AOF scores indicate an individual's ability to access implicit self-representations, even un-

der threatening conditions (Kuhl & Kazén, 1994).

AOD describes an individual's ability to initiate actions. State-oriented persons, in this case, struggle to begin an intentional action. This goes along with the postponement of decisions, and procrastination (Blunt & Pychyl, 1998).

AOP relates to maintaining an action-oriented mindset for as long as it is necessary to complete a task successfully. While action-oriented individuals can firmly focus on the task without being distracted by alternative actions, state-oriented persons tend to switch between different activities without any good reason (Kuhl & Beckmann, 1994). By definition, being action-oriented appears to be beneficial in various situations, while being state-oriented tends to have more disadvantages.

Previous research has shown that differences in AOF and AOD are associated with occupational performance (Diefendorff, Hall, Lord, & Streat, 2000; Landman, Nieuwenhuys, & Oudejans, 2016) and academic achievement, although the influence of AOP on these factors has not been examined. These studies indicate that AOF and AOD affect an individual's occupational or academic performance independently. For instance, Diefendorff et al. (2000) analyzed the impact of action control on supervisor ratings of job performance. The authors demonstrated that interindividual differences in action control have a predictive value above and beyond the commonly used demographic and personality measures when it comes to occupational performance. Here, they found that high AOD scores were consistently positively related to performance ratings, as expected.

Boekaerts and Otten (1993) present similar findings associated with academic performance. The authors showed that action control is associated with learning-related effort, which leads to better performance in a reading-comprehension task, in seventh grade students. Interestingly, high AOD values were positively related to intended and actual effort, while high AOF values showed a negative association with learning-related effort. These results in part match those of Perry, Hladkyj, Pekrun, and Pelletier (2001) who showed that failure-preoccupied (low AOF) students outperform their fellow students when they also scored high on academic control.

Further noteworthy findings by Jaramillo and Spector (2004) come from observing undergraduate marketing students. The authors also showed that interindividual differences in action control were related to achievement-relevant variables, like effort and emotional exhaustion, which are preconditions of academic performance. They demonstrated that AOD was positively associated with effort, while AOF had a negative association with emotional exhaustion.

Additionally, some studies have revealed a mediating effect of action orientation in achievement-related contexts. For example, Halvari, Ulstad, Bagøien, and Skjesol (2009) showed that volitional abilities mediate the relationship between autonomy support by teachers or coaches, and involvement in sports in adult students.

Interestingly, up to now, no study has investigated the relationship between volition in terms of action control and other prominent achievement-related variables, such as fluid intelligence and conscientiousness, at the level of secondary education. The current study is the first to analyze the relationship among action control, fluid intelligence, conscientiousness, and secondary school achievement in terms of final grade. To get a comprehensive understanding of volitional aspects in the school context, action control, fluid intelligence, conscientiousness, and sex were included in a multiple regression model as statistical predictors of final grade.

Method

Sample Size Estimation

A statistical power analysis was performed using G-Power (Faul, Erdfelder, Buchner, & Lang, 2009). The estimation of the sample size was approximately $N = 138$. The analysis was based on a multiple regression with a medium effect size $f^2 = .15^1$, $\alpha = .05$, $\beta = 0.95$, two-tailed, and with five predictors. Therefore, for the proposed project a sample size of 224 subjects is more than adequate for the main objective of this study.

Dataset

The study includes data from 224 neurologically and psychologically healthy subjects

(mean age = 23.20 years, 111 males). The sample mainly comprised university students of different majors (e.g., psychology, biology, management and economics, and sports), who received either an expense allowance of €10 per hour or course credits. The study protocol was approved by the local ethics committee. All participants had to give their written informed consent and were treated in accordance with the declaration of Helsinki.

Procedure

Subjects underwent a telephone screening to check if they were suitable for participation. Exclusion criteria were psychological or neurological diseases, poor German language skills, and any prior experience with intelligence or personality tests, among others.

First, demographic data were collected for every participant, including the participant's sex (male = 0, female = 1), age, and field of study. Subsequently, the behavioral data were collected by the use of paper-pencil-tests. Test sessions were conducted in a group setting of up to six subjects in parallel.

School Achievement

School achievement was quantified by the final grade of secondary education, and obtained retrospectively from the participants' secondary school diploma. In Germany, pupils usually receive their secondary education grading after 12 or 13 years of schooling. The final grade derives from the different grades received in the last four semesters of secondary education, as well as the results of several final exams. The secondary school diploma qualifies pupils to attend a German university. In Germany, grades range from 1 to 6, with 1 being the best, while grades 5 and 6 equal academic failure. Since all participants graduated successfully, the scale of grades presented in this study ranges from 1 to 4. To ease interpretation, grades were inverted so that higher values indicate better school achievements.

¹ Since there are no previous studies on this topic, exact effect sizes are unknown. Therefore, a medium effect size of .15 (Cohen, 1992) was assumed, in order not to over- or underestimate the actual effect.

Volition

The action control scale by Kuhl (1990; German version: HAKEMP 90) was used to capture interindividual differences in volition. The questionnaire records each participant's degree of action control under different circumstances: (i) action orientation subsequent to failure versus preoccupation (AOF; Cronbach's alpha = .70); (ii) prospective and decision-related action orientation versus hesitation (AOD; Cronbach's alpha = .78); and (iii) action orientation during (successful) performance of activities (AOP; Cronbach's alpha = .74) (Kuhl & Beckmann, 1994).

Each of the subscales is represented by 12 items. With each item, the participant is confronted with a situation and has to choose one out of two possible behaviors. This answer is either action- or state-oriented (see Table 1).

The individual's degree of action control is calculated by summation of the action-oriented answers of each scale, which leads to a total value between 0 and 12. High values in action control represent higher volitional abilities.

Fluid Intelligence

Fluid intelligence was measured with the short version of a German matrix reasoning test called "Bochumer Matrizenest" (BOMAT; Hossiep, Hasella, & Turck, 2001). The BOMAT is a non-verbal intelligence test that is very similar to Raven's Advanced Progressive Matrices (Raven, Raven & Court, 1998). Due to its considerably high discriminatory power in samples with generally

high intellectual abilities, ceiling effects can be avoided (Jaeggi, Buschkuhl, Jonides, & Perrig, 2008). The BOMAT inventory comprises two parallel test forms (A and B, Cronbach's alpha = .92 for each test form) with 29 matrix-reasoning items each (Hossiep et al., 2001). Participants had to complete only one of the two test forms, which were randomly assigned to them. Test performance in the BOMAT inventory was computed as a sum score of the last 28 items. The first item was disregarded due to its low difficulty as recommended by the test manual. The mean duration of the test is about 60 min including instructions.

Conscientiousness

To measure conscientiousness, we used the German version of the Revised NEO Personality Inventory (NEO-PI-R; Ostendorf & Angleitner, 2004). The NEO-PI-R has a total number of 240 items. Thus, each subscale (agreeableness: Cronbach's alpha = .90; conscientiousness: Cronbach's alpha = .93; extraversion: Cronbach's alpha = .89; neuroticism: Cronbach's alpha = .92; and openness: Cronbach's alpha = .89) is represented by 48 test items (Ostendorf & Angleitner, 2004). Given the present study's focus on conscientiousness, only participants' conscientiousness values will be reported. Individual conscientiousness values were computed as a sum score of the 48 items that constitute the conscientiousness scale. The individual score of each item depends on the answer given by the participant (strong disagreement = -2, disagreement = -1, neutral = 0, agreement = 1, strong agreement = 2). The NEO-PI-R takes about 45 min to complete.

Table 1
Sample Items From ACS-90

Scale	Sample question
AOF	When I am told that my work has been completely unsatisfactory: A) I do not let it bother me for too long. B) I feel paralyzed.
AOD	When I do not have anything in particular to do and I am getting bored: A) I have trouble getting up enough energy to do anything at all. B) I quickly find something to do.
AOP	When I am watching a really good movie: A) I get so involved in the film that I do not think of doing anything else. B) I often want to get something else to do while I am watching the movie.

Note. Sample items for each of the three ACS-90 scales. AOF = action orientation subsequent to failure versus preoccupation; AOD = prospective and decision-related action orientation versus hesitation; AOP = action orientation during (successful) performance of activities. Action-oriented answers are highlighted in bold.

Statistical Analysis and Integration of Data

Statistical analyses were carried out using SPSS version 20 (SPSS Inc., Chicago, IL) and Mplus (Version 7.4; Muthén & Muthén, 2015). For all analyses, linear parametric methods were used. Testing was two-tailed with an α -level of $p < .050$. First, we computed Pearson's correlation coefficients among final grade, and the different behavioral measures, namely AOF, AOD, AOP, conscientiousness, and fluid intelligence. To test the significance of mediation analysis, a bootstrapping (10,000) method was used.

To find out whether one of these variables makes a unique contribution in predicting school achievement, a multiple regression analysis was computed. Here, a forced entry method was conducted that included all predictor variables simultaneously. AOF, AOD, conscientiousness, and fluid intelligence were included into the model as predictors of final grade. AOP was not included in the model since it was not significantly correlated with final grade (see Figure S1c). Since previous studies have shown that females tend to outperform males at the level of secondary education, sex was included as a predictor in addition to the psychological measures (Deary, Strand, Smith, & Fernandes, 2007; Downey & Vogt Yuan, 2005; Ellis, 2008, p. 278; Fischer, Schult, & Hell, 2013).

Results

To understand the influence of volitional processes on school achievement, the relationship among action control (AOF, AOD, AOP), fluid intelligence, conscientiousness, and final grade (see Table S1 for descriptive data) was quantified in terms of Pearson's correlation coefficients (see Table 2 and Figure S1).

Our results showed that individuals who attained higher scores in AOD were more successful in school, and achieved better final grades, $r = .20$, $p = .002$. Notably, higher AOF scores were related to poorer final grades, that is, lower school achievement, $r = -.19$, $p = .004^2$. Regarding fluid intelligence, $r = .24$, $p < .001$, and conscientiousness, $r = .17$, $p = .011$, we found the expected relationships with final grade, indicating that higher fluid intelligence and a more conscientious personality were as-

sociated with better grades, and therefore higher school achievement.

To determine which factors uniquely contribute to predicting interindividual differences in final grade, a forced-entry regression analysis was conducted. This regression was significant ($F(5, 218) = 8.68$, $p < .000$, $R^2 = .17$). The results of the regression analysis with AOF, AOD, conscientiousness, fluid intelligence, and sex as predictors, and final grade as a criterion are shown in Figure 1.

The analysis indicated that AOF ($\beta = -.18$, $p = .006$, 95% CI $[-.31, -.05]$) and AOD ($\beta = .17$, $p = .037$, 95% CI $[.02, .33]$) made unique contributions toward predicting final grade, beyond fluid intelligence. However fluid intelligence remained the most predictive value ($\beta = .26$, $p < .001$, 95% CI $[.23, .30]$) in the model.

In contrast, conscientiousness ($\beta = .02$, $p = .814$, 95% CI $[-.13, .17]$) did not make a significant unique contribution toward predicting the individual's final grade. Furthermore, sex ($\beta = .14$, $p = .051$, 95% CI $[.01, .27]$) failed to reach significance as a uniquely contributing factor. A potential reason for conscientiousness failing to make a unique contribution toward final grade might have been that conscientiousness was strongly related to volitional tendencies, especially to AOD (see Table 2). Thus, it might have been possible that the results of prior studies reporting a significant relationship between conscientiousness and school achievement might have been explained by the fact that this relationship was mediated by volitional factors. To verify this assumption, we conducted a mediation analysis regarding the effects of volition on the relationship between conscientiousness and final grade ($R^2 = .03$, $F(1, 222) = 6.57$, $p < .05$). As Figure 2 illustrates, there was significant indirect effect of conscientiousness on final grade through AOD ($\beta = .12$, $p = .010$), whereas the indirect effect of conscientiousness on final grade through AOF was not significant ($\beta = .02$, $p = .127$). Most importantly, the direct effect of conscientiousness on final grade was not significant either ($\beta = .02$, $p = .762$).

In accordance with previous studies, our results indicated that females ($M_{\text{women}} = 2.64$,

² There was no significant association between AOP and final grade, $r = -.09$, $p = .202$

Table 2
Inter-Correlations of Main Variables

Main variables	AOF	AOD	AOP	Conscientiousness	Fluid intelligence
Final grade	-.19**	.20**	-.09	.17*	.24**
AOF	—	.09	-.03	.11	.08
AOD	—	—	.18**	.58***	.03
AOF	—	—	—	.16*	.00
CONSCIENTIONSNESS	—	—	—	—	.05

Note. N = 224. Pearson's correlation analyses of the main variables. AOF = action orientation subsequent to failure versus preoccupation; AOD = prospective and decision-related action orientation versus hesitation; AOP = action orientation during (successful) performance of activities.

* $p < .050$ (two-tailed). ** $p < .010$ (two-tailed). *** $p < .001$ (two-tailed).

$SD = .71$) achieved better final grades than males ($M_{\text{men}} = 2.32$, $SD = .72$), $t(222) = -3.32$, $p = .001$ (see Figure S2a).

We also found sex differences in volition and conscientiousness. Here men tended to reach higher scores in AOF ($M_{\text{women}} = 5.15$, $SD = 3.01$; $M_{\text{men}} = 7.10$, $SD = 2.89$), $t(222) = 4.94$, $p < .001$ (see Figure S2b), while women showed more pronounced values in AOD ($M_{\text{women}} = 7.32$, $SD = 2.94$; $M_{\text{men}} = 5.65$, $SD = 3.10$), $t(222) = -4.14$, $p < .001$ (see Figure S2c)³, and conscientiousness ($M_{\text{women}} = 125.61$, $SD = 22.91$; $M_{\text{men}} = 118.42$, $SD = 20.56$), $t(222) = -2.47$, $p = .014$ (see Figure S2e). There was no significant sex difference in fluid intelligence ($M_{\text{women}} = 15.59$, $SD = 3.63$, $M_{\text{men}} = 16.26$, $SD = 3.83$), $t(222) = 1.34$, $p = .181$ (see Figure S2f). These results suggest that different manifestations in volition might explain why women generally tend to achieve better school grading. Hence, it might be possible that women perform better in school because they show more prospective and decision-related action orientation (AOD). Men, in contrast, appear to be less successful in school due to greater action orientation after failure (AOF). To evaluate the effects of volition on the relationship between sex and school achievement, another mediation analysis was conducted ($R^2 = .05$, $F(1, 222) = 10.99$, $p < .01$). This analysis yielded a remarkable result. As Figure 3 illustrates, there was a significant indirect effect of sex on final grade through AOD ($\beta = .05$, $p = .020$), and a significant indirect effect of sex on final grade through AOF ($\beta = .06$, $p = .020$). Importantly, the direct effect of sex on final grade was not significant ($\beta = .11$, $p = .110$). Thus, women outperformed their

fellow students due to a beneficial shaping in action control.

Discussion

Our results show that interindividual differences in action control predict differences in school achievement at the level of secondary education. The present findings add to prior research since they are the first to analyze the interplay of volition and other variables influencing academic performance. We showed that AOF and AOD make a unique contribution toward predicting final grade beyond fluid intelligence, conscientiousness, and sex.

The study demonstrated that AOD is associated with higher final grades and therefore higher school achievement. This means individuals that effectively implement difficult intentions without postponement perform better in school. As mentioned earlier, comparable results were found in relation to sport (Heckhausen & Strang, 1988), education (Boekaerts, 1994; Jaramillo & Spector, 2004), and work (Diefendorff et al., 2000). These studies emphasize that the ability to initiate actions, like starting to prepare for an exam or starting with a certain task, is directly related to being successful in various aspects of life.

Regarding action orientation after failure (AOF), our study shows support toward AOF being negatively associated with final grading. This means that individuals who can discard unfavorable emotions associated with a nega-

³ There was no significant sex difference in AOP ($M_{\text{women}} = 9.84$, $SD = 2.20$; $M_{\text{men}} = 9.41$, $SD = 2.13$), $t(222) = -1.50$, $p = .134$ (see Figure S2d).

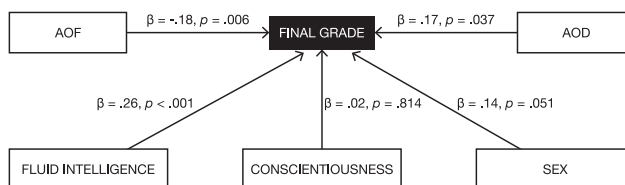


Figure 1

Figure 1. Results of multiple regression analysis. Multiple regression model for the prediction of final grade. Final grade was regressed using AOF (action orientation subsequent to failure vs. preoccupation), AOD (prospective and decision-related action orientation vs. hesitation), conscientiousness, fluid intelligence, and sex as factors. Standardized regression coefficients are depicted next to the respective lines.

tive event or failure and move on to new tasks are less successful in school. This emphasizes that the different types of action control are not additive but differentially effective when it comes to influencing an individual's academic performance (Boekaerts, 1994).

Our results regarding AOF are congruent with those of various other studies (Boekaerts & Otten, 1993; Diefendorff, 2004; Jaramillo & Spector, 2004; Perry et al., 2001). However, the rationale behind this interaction is only theoretical. For instance, Perry et al. (2001) suggest that individuals with low AOF scores but high academic control strive to understand the causes of previous failures, and in turn strive harder to achieve better results in upcoming examinations. One possible reason for this might be that individuals with low AOF scores show a neurophysiological reaction to harmful events and emotions that differs from those with high AOF scores (Quirin, Kuhl, & Düsing, 2011). Negative emotions are considered to be warning signals, indicating that a situation is unfamiliar or potentially dangerous and therefore requires greater attention to be dealt with (Bless & Fiedler, 2006). The differing neurophysiological reaction of low AOF individuals might be an indication of impaired emotion regulation abilities. If low AOF individuals have a harder time regulating negative emotions (Kuhl & Beckmann, 1994), these warning signals might have a stronger effect on them. This could lead to extensive planning and problem-solving, which in turn results in better academic achievement (Kazén, Kuhl, & Quirin, 2015; Kuhl & Kazén, 1999).

Furthermore, it is considered that individuals with low AOF scores derive motivation not only

from expecting positive outcomes, but also from a certain level of fear of failure (Hirschauer, Aufhammer, Bode, Chasiotis, & Künne, 2018; Shah & Higgins, 2001). This is in line with the results of Diefendorff (2004), who proposes that in situations in which planning and persistence are essential, such as successfully finishing high school, "ruminating about the possibility of failure may result in more cautious and deliberative goal-directed behavior."

Another possible explanation why high AOF scores adversely affect school performance was given by Baumann, Kaschel, and Kuhl (2005). Baumann et al. (2005) showed that AOF was related to higher motive congruence under threatening events. This means that individuals with high AOF scores stick to their self-concepts, needs, and motives even under threatening conditions (Baumann & Kuhl, 2002; Kazén, Baumann, & Kuhl, 2003; Kuhl & Kazén, 1994). This is generally positive since intentions that are not compatible with one's self and personal motives are rejected; this, in turn, is associated with physical and mental well-being (Baumann et al., 2005; Gröpel & Kuhl, 2009; Rhoads, Michas, & Shroff, 1989). However, in situations where school achievement is threatened, it may be important to temporarily rest one's needs to improve school performance. While individuals with high AOF scores potentially struggle to adjust their needs, state-oriented (low AOF) persons conversely "seem to follow the instructions of others as closely as possible" (K. Roth & Strang, 1994), which might be helpful regarding school achievement.

The results of our multiple regression analysis further demonstrate that AOD and AOF

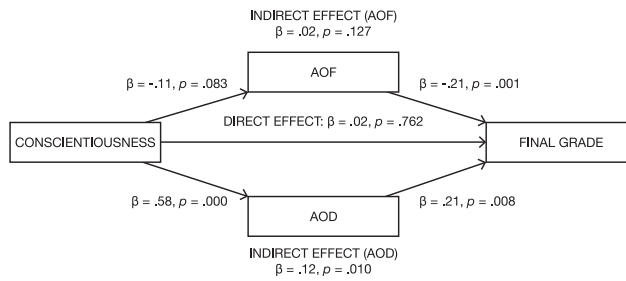


Figure 2. Mediation analysis of the relationship between conscientiousness and final grade. Results of the mediation analysis between conscientiousness and final grade using AOF (action orientation subsequent to failure vs. preoccupation) and AOD (prospective and decision-related action orientation vs. hesitation) as factors. Standardized coefficients are depicted next to the respective arrows. Direct and indirect effects are depicted next to the respective effect.

make unique contributions toward predicting final grade, and therefore school achievement, even beyond fluid intelligence, personality, and sex. Although the correlation analysis yielded a significantly positive association between conscientiousness and final grade, conscientiousness proved to be a nonsignificant predictor in the regression model.

Regarding the interplay between action control and other prominent factors influencing academic achievement, for example, personality and sex, the most striking results of the present study were those of the mediation analyses. Here, our first mediation analysis suggests that the often-reported relationship between conscientiousness and school achievement (e.g., Dumfart & Neubauer (2016)) is entirely mediated by AOD. Up to now, this relation was not recognized as former studies did not include volitional aspects while analyzing the noncognitive predictors of school achievement.

Another important insight of our study relates to the sex differences in school achievement. Our mediation analysis shows that sex differences in final grade are fully mediated by differences in AOF and AOD, suggesting that girls perform better in school not because they are girls, but because they are less action-oriented after failure (low AOF) and more action-orientated when it comes to decision-making (high AOD). In contrast, boys may fall behind because they are less affected by negative events or previous failures (high AOF) and tend to hesitate when it comes to decision-making (low AOD). These results are in accordance with studies of Carvalho (2016) and Fischer et

al. (2013), who showed that the differences in school achievement in favor of girls are due to differences in personality.

The individual differences in action control are a major influencing factor on school achievement, beyond fluid intelligence, sex, and conscientiousness. Since AOF and AOD are much narrower traits than conscientiousness, for example, they might be suitable targets for training interventions (Kuhl, 2000). Thus, the question arises of how we might use this insight to improve school performance in young students.

First of all, it is important to note that action and state orientation seem to influence the performance of an individual, not his or her ability to complete a task. Various experimental studies indicate that depending on the nature of the task, action- and state-oriented persons behave more or less successfully (Heckhausen & Strang, 1988; Jostmann & Koole, 2007). For instance, Kazén, Kaschel, and Kuhl (2008) showed that state-oriented individuals perform comparably well when the demands of a task are low, and their mood is positive. Under demanding conditions however, action-oriented persons tend to perform significantly better than state-oriented individuals. The reason for this is that action-oriented individuals are capable of intuitive affect regulation, especially when they are facing a demanding task (Jostmann, Koole, Van Der Wulp, & Fockenberg, 2005; Kazén et al., 2008; Koole & Jostmann, 2004). Thus, individuals with high AOD values modulate their affective states so that they become congruent with their motives, contextual constraints, and

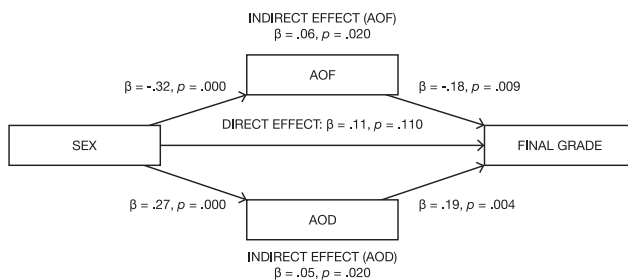


Figure 3. Mediation analysis of the relationship between sex and final grade. Results of the mediation analysis between sex and final grade using AOF (action orientation subsequent to failure vs. preoccupation) and AOD (prospective and decision-related action orientation vs. hesitation) as factors. Standardized coefficients are depicted next to the respective arrows. Direct and indirect effects are depicted next to the respective effect.

goal intentions. This in turn helps them to initiate intentions and quickly decide between two competing alternatives.

Since the successful initiation of decisions was related to better performance in various educational contexts (Boekaerts, 1994), it is critical that individuals with low AOD scores have positive affect when performance is needed. Thus, it is necessary that people who tend to hesitate (low AOD) trigger their positive affect extrinsically (Koole, Kuhl, Jostmann, & Vohs, 2005) or learn how to cope with unavoidable negative events (Kuhl, 2000). Here, evaluated sport psychological methods, like self-instruction, might be useful in improving the performance of individuals with low AOD scores (Strang, 1994).

While state-oriented individuals are regulated by extrinsic stimulation and motivation, individuals with high action orientation scores are known to stick with their personal motives even in demanding situations (Baumann et al., 2005; K. Roth & Strang, 1994). Therefore, teachers should try to stimulate the intrinsic motivation of students with high AOF scores to improve their academic performance.

There are some limitations to the present study that are worth discussing with the aim of interpreting the results correctly and to improve future research. First and foremost, final grades were assessed retrospectively. Thus, the predictor variables come after the outcome variable. Even though interindividual differences in action control (Kuhl, 1992), personality (Maltby, Day, & Macaskill, 2010), and intelligence (Deary, Whalley, Lemmon, Crawford, & Starr,

2000) are known to be quite stable over lifetime, it is not impossible that various life events, such as having a successful high school experience, affect self-reported volition or personality. Moreover, there are some selection processes, before students enter university. Some areas, for example, psychology or medicine, only admit students with excellent secondary school diplomas. Even though students from various majors participated in this study, a vast majority of participants studied psychology. Therefore, these students might not be representative of all secondary school students. To avoid these issues, it is highly recommended that future studies assess action control, personality, and cognitive abilities prior to or at the same time as academic achievement.

As previously mentioned, interindividual differences in action control take effect depending on situational factors (Heckhausen & Strang, 1988; Jostmann & Koole, 2007; Kazén et al., 2008; Quirin et al., 2011). Hence, how people perceived the conditions around their secondary school leaving diploma varies greatly. Therefore, future studies should assess situational factors, such as individual stress levels, during testing.

Due to the correlational nature of the current study, one has to be careful not to derive any causal relations from the aforementioned findings. Nevertheless, we believe that our results add noteworthy information to research on action control and academic achievement. We showed that volitional aspects, regarding action control, significantly contribute toward academic achievement on the level of secondary

education, above and beyond other prominent influencing factors, namely fluid intelligence, conscientiousness, and sex. Thus, it is recommended to include volition in future studies analyzing the noncognitive correlates of school achievement. To improve insight into the effects of interindividual differences in action control, it would be interesting to include younger students into the studies and to take other achievement-relevant contexts into consideration, for example, work or college admission processes.

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