**Academic self-efficacy and learning strategies as mediators of the relation between personality and elementary school students' achievement**


## Abstract

In this study, we examined the mediating role of academic self-efficacy and motivational learning strategies in the relationship between personality and elementary school students' achievement. The data were collected using a questionnaire that was administered to 511 Croatian eight-grade students (14-15 years old) and analysed using Hayes's PROCESS procedure. The results suggest that conscientious students have higher grade point average (GPA) which can partially be explained with their relatively high academic self-efficacy and avoidance of using strategies of protecting self-esteem. Findings also indicate serial mediating effects of academic self-efficacy and strategies of protecting self-esteem on the relationship between conscientiousness and GPA. Openness was positively related to GPA, but only indirectly, through academic self-efficacy. Furthermore, we found an indirect effect of agreeableness on GPA through less frequent use of strategies aimed at protecting self-esteem. Neuroticism and extraversion showed no direct nor indirect effects on GPA. Additionally, students with higher academic self-efficacy were less inclined to use strategies of protecting self-esteem. However, there was no effect of academic self-efficacy on strategies of promoting learning process. This study adds to the existing literature by specifically examining serial mediation of academic self-efficacy and learning strategies in the relationship between personality and GPA.



**Keywords:** academic achievement; academic self-efficacy; learning strategies; personality; elementary school


## Introduction

Emergence of the five-factor model over the last two decades provided a universally accepted theoretical framework for the research on the role of personality in learning (Poropat, 2016). Five broad dimensions proposed by the model – neuroticism, extraversion, openness to experience, agreeableness and conscientiousness – have been empirically supported in a variety of cultures (McCrae & Allik, 2002), enabling educational researchers to examine the role of individual differences in educational outcomes beyond cognitive abilities. Several meta-analyses in the last decade highlight the most important findings on the complex relations

between personality, learning motivation and academic achievement (McAbee & Oswald, 2013; Poropat, 2009; 2014a; Schneider & Preckel, 2017).

*Personality and achievement*

Majority of the studies focused on the role of personality in academic achievement, highlighting conscientiousness as the most important personality determinant of educational performance across all educational levels (Bratko, Chamorro-Premuzic & Saks, 2006; Poropat, 2016; Vedel & Poropat, 2017). This relation is particularly strong when conscientiousness is rated by significant others such as parents or teachers (Poropat, 2014a; MacCann, Lipnevich, Poropat, Wiemers, & Roberts, 2015). Self-discipline, orderliness and achievement-striving of conscientious students facilitate adaptive learning behaviours such as academic effort, resulting in higher academic performance at both pre-tertiary and tertiary educational levels (Noftle & Robins, 2007; Trautwein, Lüdtke, Roberts, Schnyder, & Niggli, 2009). Meta-analytic data suggest that this relation is highest in elementary education and robust across different educational contexts, with the size of effects on performance comparable to those of intelligence (Poropat, 2009; 2016). Conscientiousness is related to achievement across different academic domains such as mathematics or physics (Spinath, Freudenthaler, & Neubauer, 2010; Vrdoljak, 2015). Openness to experience is another personality dimension that has been consistently related to higher achievement across different educational levels (Poropat, 2009; 2014 a, b; Bratko, Chamorro-Premuzic & Saks, 2006), particularly when parent or teacher ratings were used (Poropat, 2014 a, b). Intellectual curiosity of open students promotes the development of learning - oriented motivational patterns which are, in turn, reflected in academic performance (Komarraju, Karau, & Schmeck, 2009). The role of agreeableness in educational achievement is less consistently documented compared to conscientiousness and openness. As an interpersonal dimension, agreeableness refers to the quality of relations with others, resulting in prosocial and cooperative attitudes (Graziano & Eisenberg, 1997). Meta-analytic evidence underlines that agreeableness is particularly important for student achievement in primary education, while this relation for self-ratings of agreeableness diminishes at the secondary and tertiary level (Poropat 2009). Other-rated agreeableness, however, demonstrates low correlations with academic achievement across educational levels (Poropat, 2014 a, b). Cooperativeness and compliance of agreeable students appear to be particularly advantageous at the level of primary education, where relations with teachers and peers are closer and favourable ratings of socially desirable student behaviours are reflected in teacher assessments of student achievement (Vedel & Poropat, 2017). Extraversion is another interpersonal

dimension positively related to academic achievement at the elementary school level, while this relation diminishes or even becomes modestly negative in secondary and tertiary education (Poropat, 2009, 2016; Noftle & Robins, 2007). As with agreeableness, closer interactions with students in the elementary school classrooms may result in teacher ratings that are more saturated with personality factors, while more distant relations with students reduce the role of student personality in teacher assessments of student achievement at the higher levels of education (Poropat, 2009). In addition, sociability of extraverted students could be advantageous for academic performance at the elementary school level where social relations play a more prominent role, while at the higher educational levels it may have adverse effects on student learning (Vedel & Poropat, 2017). Self-rated emotional stability has a modest positive relation to academic performance only at the elementary school level, while modest correlations of other-rated emotional stability with achievement remain stable across educational levels (Poropat, 2009; 2014 a, b). Emotionally stable students are less prone to anxiety and negative affect that interfere with learning and result in poorer performance (Sorić, Penezić, & Burić, 2013). However, the role of emotional stability in academic performance appears to be more complex, with the tendency of emotionally stable students to spend less time on learning tasks such as homework or rehearsal (Vedel & Poropat, 2017).

*Academic self-efficacy and learning strategies as mediators of personality-achievement relations*

Personality traits are broad dispositions that are reflected in behaviours, thoughts and feelings characteristic of a person (McCrae & Costa, 1999), which implies indirect effects on learning outcomes. Previous research has mainly focused on aspects of self-regulated learning and self-presentations as two broad categories of mediating variables (Poropat, 2016). Much of this research has been focused on mediating effects of conscientiousness and openness as dimensions most consistently related to academic performance. In German mathematics classes, academic effort mediated the relationship between conscientiousness and achievement (Trautwein et al., 2009). Effort regulation mediated the relations between conscientiousness and agreeableness on university grades (Bidjerano & Dai, 2007). Openness has been linked to the use of deep learning strategies (Chamorro-Premuzic & Furnham, 2009). In line with this, the relationship between openness and performance has been partly mediated through reflective learning styles (Komarraju, Karau, Schmeck, & Avdic, 2011). Lower use of surface learning strategies mediated the positive effect of emotional stability on mathematics grades, while homework behaviour mediated the positive effects of agreeableness on grades in mother tongue

in Dutch secondary schools (Lubbers, Van Der Werf, Kuyper, & Hendriks, 2010). Personality traits are related to learning strategies and grades in physics classes (Vrdoljak, 2015). Conscientious and open students more frequently use deep and metacognitive learning strategies and are less prone to using surface learning. In line with the well documented contribution of conscientiousness to achievement, conscientious students had higher grades in physics. Agreeable students were prone to the more frequent use of metacognitive learning strategies but had lower grades in physics. Testing the effects of five personality factors on achievement through academic motivation, De Feyter, Caers, Vigna, and Berings (2012) found that academic motivation mediated the effects of conscientiousness on achievement at the university level. Conscientiousness and openness were also found to have indirect effects on academic achievement through self-efficacy in secondary school (Di Giunta, Alessandri, Gerbino, Kanacri, Zuffiano, & Caprara, 2013; Caprara, Vecchione, Alessandri, Gerbino, & Barbaranelli, 2011; McIlroy, Poole, Ursavas, & Moriarty, 2015). A recent meta-analysis further clarified the effects of personality and self-efficacy on achievement, indicating that self-efficacy mediates the relations of conscientiousness and emotional stability with academic performance (Stajkovic, Bandura, Locke, Lee, & Sergent, 2018).

*The present study*

So far, the relationship between personality and academic performance has been explored either through self-efficacy or through learning strategies. However, drawing from the conceptual framework suggesting the effects of cognitive and motivational beliefs and strategies on academic achievement (Lončarić, 2008; 2011), self-efficacy beliefs can also influence learning strategies, which can in turn influence academic achievement. The aim of the present study was therefore to examine the role of academic self-efficacy and motivational learning strategies in the relationship between personality and academic performance. A model of hypothesized relations is presented in Figure 1.

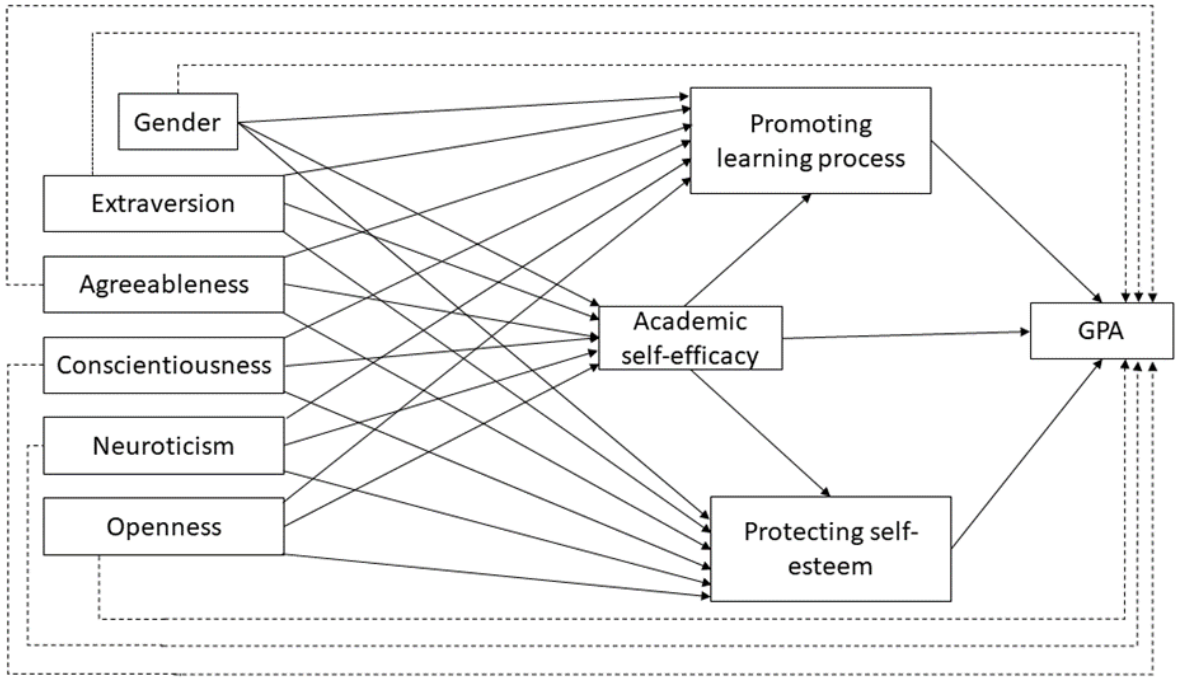


Figure 1. Proposed model of the effects of personality traits on GPA through academic self-efficacy and two types of motivational learning strategies: promoting learning process and protecting self-esteem

We expected that a) personality traits, particularly conscientiousness and openness, would have a significant effect on academic self-efficacy, learning strategies and grade point average (GPA). We also expected that b) academic self-efficacy would have a significant effect on both types of motivational learning strategies; promoting learning process and protecting self-esteem. Further, we expected that c) academic self-efficacy and motivational learning strategies would have a significant effect on GPA, and that d) academic self-efficacy, as well as motivational learning strategies would mediate the relationship between personality and GPA. Finally, we expected e) serial mediation, which means that personality traits have an effect on academic self-efficacy, which in turn affects motivational learning strategies, which then have an effect on GPA. All hypotheses were tested controlling for the effects of gender.

## Method

*Participants and procedure*

This research was part of a larger study aimed at assessing learning competencies of students in the final year of elementary education, prior to the transition into high school. The sample consisted of 511 eight-grade students from 36 elementary schools in Zagreb and Zagreb County

participated in the study. Students were 14-15 years old, 56% were female and 44% male. Sample was stratified according to size and rural-urban location of the school.

Prior to questionnaire administration, informed consent was obtained from students' parents and anonymity of data was ensured. The questionnaires were administered in paper-pencil form in schools during regular school classes.

*Instruments*

*Personality*

The Big Five Inventory (BFI) (John & Srivastava, 1999) was used to measure basic personality dimensions: extraversion (eight items, $\alpha = 0.73$), agreeableness (nine items, $\alpha = 0.71$), conscientiousness (nine items, $\alpha = 0.77$), neuroticism (eight items, $\alpha = 0.73$) and openness to experience (ten items, $\alpha = 0.71$). This instrument has been validated and commonly used for research purposes in the Croatian context (Kardum et al., 2006). The BFI includes 44 statements which participants endorse on a 5-point Likert-type scale from 1 = *strongly disagree* to 5 = *strongly agree*. Sample items include "I see myself as someone who is talkative." (extraversion), "I see myself as someone who is helpful and unselfish with others." (agreeableness), "I see myself as someone who does things carefully and completely." (conscientiousness), "I see myself as someone who is depressed, blue." (neuroticism), and "I see myself as someone who is original, comes up with new ideas." (openness to experience).

*Academic self-efficacy*

Academic self-efficacy scale from the Patterns of Adaptive Learning Scales (PALS; Midgley et al., 2000) was used as a measure of academic self-efficacy. The scale includes 5 items on a 5-point Likert-type scale with responses ranging from 1 = *not at all true* to 5 = *very true.* Sample items include "I can do almost all the work in class if I don't give up." and "Even if the work is hard, I can learn it.". Scale reliability on this sample is $\alpha = 0.86$. Croatian translation of this scale has been validated and used for research purposes (Rupčić & Kolić-Vehovec, 2004).

*Motivational learning strategies*

Motivational learning strategies were measured by a subscale from the Self-regulatory Learning Strategies Scale (Lončarić, 2014). This scale has been developed and validated on a sample of Croatian students. The validation revealed the two-factor structure of the scale: motivational learning strategies aimed at promoting learning process and motivational learning strategies aimed at protecting self-esteem (Lončarić, 2014). The scale has been frequently used in research on self-regulated learning in Croatia. Subscales measuring strategies for promoting learning

process include setting up goals, effort regulation and work/place/time management, while subscales measuring strategies for protecting self-esteem include self-handicapping, defensive pessimism and external attribution of failure. All scales use the five-point Likert-type response format ranging from 1 = *strongly disagree* to 5 = *strongly agree*. Sample items for setting up goals, effort regulation and work/place/time management include "When I study, I determine exactly what I want to achieve by studying", "As I solve a difficult task, I tell myself *I can do it* and keep trying", "Before studying, I make sure I can work in peace", respectively. Setting up goals ($\alpha = 0.81$) and effort regulation ($\alpha = 0.77$) are five-item scales, while work/place/time management ($\alpha = 0.82$) consists of six items. The score for promoting learning process was calculated as a mean of the three subscale scores. Sample items for self-handicapping behaviour, defensive pessimism and external attribution of failure are "While others study for the exam, I'm having fun.", "I always expect a poor grade so I don't get surprised if I get it." and "I got a bad grade because the teachers don't know how to make the assignments interesting.", respectively. Defensive pessimism ($\alpha = 0.79$) and external attribution of failure ($\alpha = 0.88$) are four-item scales, while self-handicapping behaviour scale ($\alpha = 0.82$) consists of five items. The score for protecting self-esteem was calculated as a mean of these three subscale scores.

*Academic success*

Grade point average (GPA) at the end of the first semester of eight grade was used as a measure of academic success. In the Croatian educational system, GPA is expressed on a scale from 1 = *insufficient* to 5 = *excellent*.

*Data analysis*

Majority of students (*N*=359; 70.3%) provided responses to all variables. Missing rates for individual variables were 7.2% (for *Openness*) or less, which resulted in an almost complete dataset (95.6% of all cells were completed). A complete-case analysis was conducted using PROCESS macro for IBM SPSS. In order to take into account the hierarchical nature of the sample and the fact that students were nested within schools, we calculated the intraclass correlation coefficient (ICC), which was .10, indicating that about 10% of variations in GPA can be explained by the fact that students attend different schools. Since IBM SPSS 20 and PROCESS macro do not support multilevel serial mediation models, we ran additional multilevel models with random intercept using mixed procedure in IBM SPSS, in order to replicate parts of the model depicted in Figure 1. (i.e. we ran separate models with GPA, academic self-efficacy, promoting learning process and protecting self-esteem as outcome

variables). These analyses resulted in similar parameter estimates as PROCESS macro. Given the similarity of the results obtained with multilevel and single-level analyses, we decided to report the findings obtained with PROCESS macro.

According to recommendations provided by Preacher and Hayes (2008), mediational analysis was conducted based on bootstrap confidence intervals. Furthermore, as Hayes (2018) suggested that the resampling procedure should include several thousand samples in order to increase precision, we included 5000 samples in our analysis. Indirect effects are considered significant in case zero is not included in bootstrap intervals. In addition, a path analysis was performed to test the fit of the overall model shown in Figure 1.

**Results**

*Descriptive statistics*

Descriptive statistics of all variables used in the study are presented in Table 1. On average, students report high levels of extraversion, agreeableness and openness, as well as moderate levels of conscientiousness and neuroticism. Furthermore, students are academically self-efficient and more inclined to use motivational strategies of promoting learning process than strategies of protecting self-esteem. The average GPA corresponds to grade 4 (i.e. *very good*). Girls were slightly overrepresented in the sample.

Table 1. Descriptive statistics of regressors, mediators and outcome

| | M / % | SD | Range |
|---|---|---|---|
| *Regressors* | | | |
| Extraversion | 30.1 | 5.47 | 11 – 40 |
| Agreeableness | 31.7 | 5.53 | 15 – 45 |
| Conscientiousness | 30.1 | 6.08 | 13 – 45 |
| Neuroticism | 22.1 | 5.59 | 8 – 39 |
| Openness | 35.6 | 6.14 | 14 – 50 |
| Gender (%) | | | |
| Females | 56.0% | | |
| Males | 44.0% | | |
| *Mediators* | | | |
| Academic self-efficacy | 19.5 | 4.25 | 5 – 25 |
| Promoting learning process | 56.5 | 12.16 | 16 – 80 |
| Protecting self-esteem | 35.8 | 10.73 | 13 – 65 |
| *Outcome variable* | | | |
| GPA | 4.1 | 0.71 | 1 - 5 |

The correlations between regressors and potential mediators vary from negligible to medium in size (all $r$ values < |.5|; Table 2), with all corresponding variance inflation factors (VIF) smaller

than two, meaning that there are no signs of multicollinearity. All regressors and mediators are in statistically significant bivariate relationships with the outcome. The effect sizes of these correlations vary from small to medium, with academic self-efficacy and conscientiousness being the strongest correlates of GPA (Table 2).

The results indicated that skewness ranged from − .89 to .24 and kurtosis ranged from − .19 to .79 and were within the normality criteria.

Table 2. Correlations between regressors, mediators and outcome (Pearson's *r*)

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| *Regressors* | | | | | | | | | |
| (1) Extraversion | | | | | | | | | |
| (2) Agreeableness | .15** | | | | | | | | |
| (3) Conscientiousness | .29** | .35** | | | | | | | |
| (4) Neuroticism | -.36** | -.32** | -.38** | | | | | | |
| (5) Openness | .31** | .21** | .28** | -.09* | | | | | |
| (6) Gender (male) | -.11* | -.19** | -.01 | -.23** | -.21** | | | | |
| *Mediators* | | | | | | | | | |
| (7) Academic self-efficacy | .25** | .13** | .46** | -.25** | .32** | .05 | | | |
| (8) Promoting learning process | .11* | .31** | .47** | -.14** | .25** | -.03 | .33** | | |
| (9) Protecting self-esteem | -.13** | -.33** | -.47** | .31** | -.18** | .03 | -.38** | -.39** | |
| *Outcome variable* | | | | | | | | | |
| (10) GPA | .17** | .12** | .36** | -.09* | .25** | -.26** | .46** | .19** | -.34** |

*Note: *p < .05; **p < .01.*

*Mediation analysis of the relationship between personality and GPA*

As can be seen from Table 3, significant regressors on GPA include gender ($\beta$=-.296; $p$<0.01), conscientiousness ($\beta$=.149; $p$<0.05), academic self-efficacy ($\beta$=.338; $p$<0.01) and protecting self-esteem ($\beta$=-.178; $p$<0.01). Girls have higher GPA than boys. More conscientious students and students who perceive themselves as academically efficient also have higher GPA. On the other hand, students who tend to use motivational learning strategies aimed at protecting self-esteem have lower GPA. More than one-third of variance in GPA can be explained by the combination of these variables. Furthermore, conscientious and open students report higher estimates of academic self-efficacy ($\beta$=.433; $p$<0.01 and $\beta$=.202; $p$<0.01, respectively). Conscientious and agreeable students are more likely to use motivational learning strategies of promoting learning process ($\beta$=.446; $p$<0.01; and $\beta$=.174; $p$<0.01, respectively). On the other hand, conscientious and agreeable students, as well as the students of high academic self-efficacy, are more likely to avoid strategies of protecting self-esteem ($\beta$=-.289; $p$<0.01; $\beta$=-.175; $p$<0.01; and $\beta$=-.228; $p$<0.01, respectively). The corresponding linear regression models result in similar shares of explained variance for academic self-efficacy, strategies of promoting learning process and protecting self-esteem (28%, 30% and 31%, respectively).

Table 3. Direct effects in the tested model

| Regressor | Outcome | | | |
|---|---|---|---|---|
| | Academic self-efficacy | Promoting learning process | Protecting self-esteem | GPA |
| | β | β | β | β |
| Gender (male) | .033 | .049 | .012 | -.296** |
| Conscientiousness | .433** | .446** | -.289** | .149* |
| Openness | .202** | .038 | .005 | .025 |
| Neuroticism | -.053 | .108 | .101 | -.025 |
| Extraversion | .013 | -.074 | .093 | -.005 |
| Agreeableness | -.054 | .174** | -.175** | -.085 |
| Academic self-efficacy | | .102 | -.228** | .338** |
| Promoting learning process | | | | -.033 |
| Protecting self-esteem | | | | -.178** |
| $R^2$ | .28** | .30** | .31** | .35** |

*Note: *p < .05; **p < .01.*

We further analysed the hypothesized mediational effects of academic self-efficacy and learning strategies on the relationship between personality and GPA. Since mediational analysis in PROCESS allows for only one regressor, we conducted separate analyses for all personality dimensions, while including other traits and gender as covariates, controlling for their effects in the relationship. This procedure, suggested by Hayes (2018), resulted in the estimates of indirect effects of personality traits on GPA.

Table 4. Indirect effects of personality traits on GPA through academic self-efficacy and motivational learning strategies

| | | | **β** |
|---|---|---|---|
| Conscientiousness | → Academic self-efficacy → | GPA | .146* |
| Openness | | | .068* |
| Neuroticism | | | -.018 |
| Extraversion | | | .004 |
| Agreeableness | | | -.018 |
| Conscientiousness | → Promoting learning process → | GPA | -.015 |
| Openness | | | -.001 |
| Neuroticism | | | -.004 |
| Extraversion | | | .002 |
| Agreeableness | | | -.006 |
| Conscientiousness | → Protecting self-esteem → | GPA | .051* |
| Openness | | | -.001 |
| Neuroticism | | | -.018 |
| Extraversion | | | -.017 |
| Agreeableness | | | .031* |
| Conscientiousness | → Academic self-efficacy ↓ Promoting learning process → | GPA | -.002 |
| Openness | | | -.001 |
| Neuroticism | | | .000 |
| Extraversion | | | .000 |
| Agreeableness | | | .000 |
| Conscientiousness | → Academic self-efficacy ↓ Protecting self-esteem → | GPA | .018* |
| Openness | | | .008* |
| Neuroticism | | | -.002 |
| Extraversion | | | .001 |
| Agreeableness | | | -.002 |

*Note: *p < .05.*

Table 4 shows indirect effects of personality traits on GPA through academic self-efficacy and motivational learning strategies. The effect of conscientiousness on GPA through academic self-efficacy is significant and positive ($\beta$ =.146; *CI*=.092, .209). Conscientious students are more likely to perceive themselves as academically efficient which is related to higher GPA. Conscientious students are also less likely to use strategies of protecting self-esteem ($\beta$=-.289, $p$<0.05) which results in higher GPA ($\beta$=.051; *CI*=.016, .099). Furthermore, the serial mediation

effect of conscientiousness on GPA through academic self-efficacy and protecting self-esteem is also significant ($\beta$=.018; *CI*=.005, .035). This indicates that low academic self-efficacy can be one of the reasons why students with low conscientiousness use strategies of protecting self-esteem, which further results in lower school grades. Indirect effects of conscientiousness on GPA through promoting learning process and through academic self-efficacy and promoting learning process did not prove significant ($\beta$=-.015, *CI*=-.061, .030; $\beta$=-.002, *CI*=-.008, .004).

Table 5. Total, direct, and indirect effects of personality traits on GPA

| | Total effect | Direct effect | Indirect effect |
|---|---|---|---|
| | β | β | β |
| Conscientiousness | .348* | .149* | .199* |
| Openness | .099 | .025 | .074* |
| Neuroticism | -.067 | -.025 | -.042 |
| Extraversion | -.014 | -.005 | -.009 |
| Agreeableness | -.080 | -.085 | .005 |

*Note: *p < .05.*

As presented in Table 5, direct effect of conscientiousness on GPA is significant controlling for mediators ($\beta$=.149; $p$<0.05), indicating that academic self-efficacy and strategies of protecting self-esteem are partial mediators of the relationship.

Despite the fact that the direct effect of openness on GPA is not significant ($\beta$=.025, $p$>0.05), the indirect effect of openness on GPA through academic self-efficacy is significant and positive ($\beta$=.068; *CI*=.029, .115), as well as the indirect effect of openness on GPA through academic self-efficacy and protecting self-esteem ($\beta$=.008; *CI*=.002, .020) and the total indirect effect of openness on GPA ($\beta$=.074; *CI*=.026, .127). In other words, open students tend to perceive themselves as academically efficient which further reflects in their higher GPA: firstly, because academic self-efficacy positively relates to GPA directly, and secondly, because academically efficient students avoid strategies of protecting self-esteem, which also leads to higher GPA. However, it has to be noted that the indirect effect of openness on GPA is small and can be attributed mostly to the effect of academic self-efficacy.

Furthermore, Table 5 shows that total, direct and indirect effects of agreeableness are not significant ($\beta$=-.080, $p$>0.05; $\beta$=-.085, $p$>0.05; $\beta$=-.005, $p$>0.05), which indicates that agreeableness has no effect on GPA. However, the indirect effect of agreeableness on GPA through protecting self-esteem is statistically significant ($\beta$=.031; *CI*=.007, .064), suggesting that agreeable students tend to avoid strategies of protecting self-esteem, which leads to higher GPA.

Extraversion and neuroticism were not found to be significant regressors on GPA, and no significant mediational effects were found for academic self-efficacy and learning strategies in these relationships.

Path analysis was performed to test the fit of the overall model. Since the fit indices were not within the acceptable thresholds ($\chi^2$=10.1, *df*=1, *p*>0.05; RMSEA=.149; CFI=.983; TLI=.498), the model was respecified. We removed the paths from gender to mediators (academic self-efficacy, promoting learning process and protecting self-esteem), from extraversion to promoting learning process, and from neuroticism to GPA. Correlation analysis, PROCESS and path analysis have all indicated that relationships between these variables were nonsignificant or negligible. The new model fitted the data ($\chi^2$=14.2, *df*=6, *p*<0.05; RMSEA=.058; CFI=.985; TLI=.924) and its parameter estimates replicated findings obtained with PROCESS procedure (Appendix Figure 2. and Table 6.).

**Discussion**

This study explored the role of academic self-efficacy and motivational learning strategies in the relationship between personality and academic performance with particular emphasis on previously unexplored serial mediation effects. We hypothesized that personality traits have both direct and indirect effects on student achievement, and that academic self-efficacy and learning strategies serially mediate this effect.

In our study, students' conscientiousness was the only personality trait that had significant effects on all outcome variables (academic self-efficacy, learning strategies and GPA), which partially confirms Hypothesis a). Conscientious students were more likely to be academically efficient, to use strategies of promoting learning process, to avoid using strategies of protecting self-esteem and to have higher GPA. In accordance with Hypothesis d), academic self-efficacy and strategies of protecting self-esteem mediated the relationship between conscientiousness and GPA. More precisely, the finding that conscientious students have higher GPA can partially be explained with their relatively high academic self-efficacy and avoidance of using strategies of protecting self-esteem. The findings of our study provide further empirical support to the already established role of conscientiousness in academic performance of elementary school students. Conscientious students are well-organized, self-disciplined and achievement-striving, which is directly reflected in their higher performance (Noftle & Robins, 2007; Poropat, 2009). In addition to direct effects, conscientiousness partly operates through motivational characteristics such as self-presentations and regulation of learning. Higher academic self-

efficacy and adaptive approach to learning of conscientious students promotes their achievement in elementary school, supporting empirical evidence obtained across different educational levels and contexts (Trautwein et al., 2009; Caprara et al., 2011; Stajkovic et al., 2018).

Open students were more likely to be academically efficient, but, somewhat surprisingly, there were no direct effects of openness on learning strategies and GPA. While meta-analytic evidence supports direct relations of openness and academic achievement (Poropat 2009; 2014), this is not the case with our sample. However, openness was indirectly related to GPA through academic self-efficacy. Open students in our study tended to have a higher GPA due to their higher academic self-efficacy, consistent with findings that both conscientiousness and openness are related to positive academic self-perceptions (Marsh, Trautwein, Lüdtke, Köller, & Baumert, 2006). Conscientious and open students tend to develop adaptive self-beliefs and behaviours that promote academic success (McIlroy, Poole, Ursavas, & Moriarty, 2015).

Similarly to conscientious students, agreeable students were more likely to promote learning process and to avoid strategies of protecting self-esteem. Furthermore, we found an indirect effect of agreeableness on GPA through less frequent use of strategies aimed at protecting self-esteem. The relation of agreeableness with academic achievement can particularly be found at the elementary school level (Poropat, 2009). Our data indicate that this relationship is mediated by self-regulated learning, in this particular case lower use of self-protective learning strategies.

Neuroticism and extraversion showed no effects on any of the outcomes. This is in line with the inconsistent findings on the role of these personality traits in academic outcomes (Poropat 2016; Vedel & Poropat, 2017).

In relation to Hypothesis b), students with higher academic self-efficacy were less inclined to use strategies of protecting self-esteem. The effect of academic self-efficacy on promoting learning process was not found, meaning that Hypothesis b) was only partially confirmed. In line with the findings that students with higher self-efficacy tend to use more effective self-regulatory learning strategies (Pajares, 2008; Zimmerman, 2000), we expected that academic self-efficacy beliefs would influence not only the use of strategies for promoting self-esteem, but also the more constructive strategy of promoting learning process. However, data did not support this hypothesis.

Further, students with higher academic self-efficacy and students who avoid using strategies of protecting self-esteem both have higher GPA, which is in line with Hypothesis c). The finding that students with higher academic self-efficacy beliefs have better grades is in line with empirical evidence on the effect of perceived self-efficacy on academic outcomes, as self-efficacy is considered one of the key predictors of student motivation and learning and, consequently, academic achievement (Lončarić, 2014; Zimmerman, 2000). When it comes to the role of using strategies of protecting self-esteem, research yields somewhat inconclusive results. While self-handicapping as one of the aspects of protecting self-esteem is negatively related to academic achievement (Schwinger, Wirthwein, Lemmer, & Steinmayr, 2014), defensive pessimism has been shown to be a functional strategy for some students, which can result in satisfactory academic achievement (Eronen, Nurmi, & Salmela-Aro, 1998). On the other hand, strategies of protecting self-esteem are considered defensive strategies and have been found to be negatively related to academic achievement (Lončarić, 2014), which is in line with our finding that students who use less strategies for promoting self-esteem have higher GPA.

Our study adds to the existing literature by examining serial mediation of academic self-efficacy and learning strategies on GPA, thus providing insights into the processes through which personality traits exert their influence on academic achievement. Findings related to Hypothesis e) point to academic self-efficacy and strategies of protecting self-esteem as serial mediators of conscientiousness on GPA. Low academic self-efficacy partially explains why students with low conscientiousness use strategies of protecting self-esteem, which further results in lower school grades. Similarly, academic self-efficacy and protecting self-esteem were serial mediators of openness on GPA. Other serial mediation effects of personality traits on GPA through academic self-efficacy and motivational learning strategies did not prove significant.

**Limitations and conclusion**

Although mediational analysis allows tentative conclusions about causality between variables by estimating direct and indirect effects, it cannot be used to imply causality because of the cross-sectional nature of the design. Assumptions of causality should therefore be guided by theory and confirmed through the use of longitudinal research design. Furthermore, the research sample included students from Croatia's capital and its vicinity, who all belonged to one age group (14-15 years old). Testing the proposed model on samples from diverse contexts and different age groups would significantly improve the generalizability of the findings. In addition, since the direct effect of conscientiousness on GPA remains significant controlling for

the effects of academic self-efficacy and motivational learning strategies, this suggests that there could also be alternative explanations of the relationship between personality and achievement. Finally, this study used self-report measures of all variables, which may have resulted in social desirability bias. These measures could be corroborated in further research by other-reports of personality and learning strategies, since these could provide more valid measured of these variables.

Despite the limitations described above, the results of the present study provide findings that contribute to understanding the complex relationship between personality and academic achievement through the effects of academic self-efficacy beliefs and motivational learning strategies. Specifically, testing a model which included academic self-efficacy and motivational learning strategies as mediators of the relationship between personality and achievement provided evidence of serial mediation – conscientious students tend to have higher academic self-efficacy, which results in avoiding the use of strategies for protecting self-esteem, which in turn leads to higher GPA. These results shed light on the important role of learning strategies as mechanisms underlying the relationship between conscientiousness, academic self-efficacy and achievement. Practical implications of this study suggest the benefits of promoting the use of adaptive motivational learning strategies to strengthen the effects of conscientiousness and academic self-efficacy on student achievement.

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## Appendix

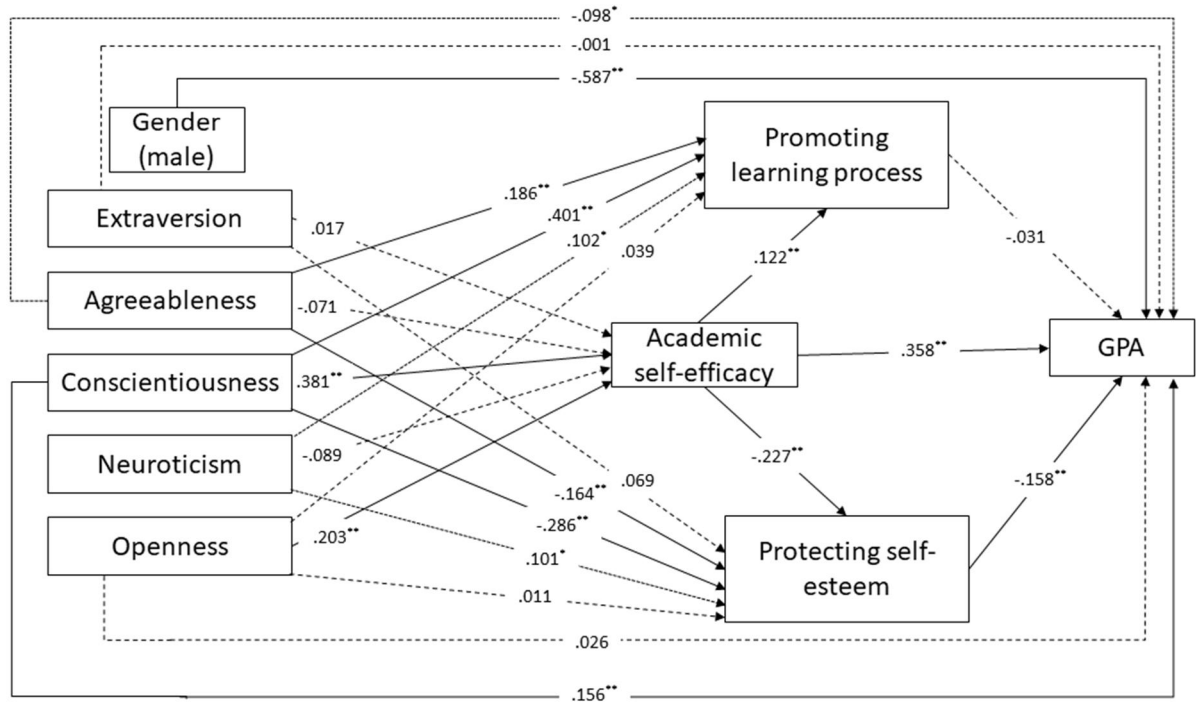


Figure 2. Path model: standardized parameter estimates of the effects of personality traits on GPA through academic self-efficacy and motivational learning strategies

*Note: Solid lines represent paths significant at p<.01. Dotted lines represent paths significant at p<.05. Dashed lines represent nonsignificant paths.*

Table 6. Path model: standardized indirect effects of personality traits on GPA through academic self-efficacy and motivational learning strategies

| | | | β |
|---|---|---|---|
| Conscientiousness | → Academic self-efficacy→ | GPA | .136* |
| Openness | | | .073* |
| Extraversion | | | .006 |
| Agreeableness | | | -.025 |
| Conscientiousness | → Promoting learning process → | GPA | -.012 |
| Openness | | | -.001 |
| Agreeableness | | | -.006 |
| Conscientiousness | → Protecting self-esteem → | GPA | .045** |
| Openness | | | -.002 |
| Extraversion | | | -.011 |
| Agreeableness | | | .026* |
| Conscientiousness | → Academic self-efficacy ↓ Promoting learning process → | GPA | -.001 |
| Openness | | | -.001 |
| Extraversion | | | .000 |
| Agreeableness | | | .000 |
| Conscientiousness | → Academic self-efficacy ↓ Protecting self-esteem → | GPA | .014* |
| Openness | | | .007* |
| Extraversion | | | .001 |
| Agreeableness | | | -.003 |

*Note: *p < .05; **p < .01.*