

Investigating the Role of Metacognitive Self-Regulation and Personality Traits in Predicting Academic Procrastination among Students

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Abstract

Aim: The aim of the present study was to explore how metacognitive techniques for self-regulation and Big Five personality factors are predictors for academic procrastination among university students.

Method: This project adopted a descriptive-correlational methodological approach. The research population included all students of universities in Ardabil Province during 2023 and 2024. Among these people, 185 participants were selected as samples for the research evaluations.

Data were analyzed using IBM SPSS Statistics version 26.0 by means of multiple linear regression and Pearson correlation analysis. Self-report data were collected through questionnaires administered to participants, including the Solomon and Rothblum Academic Procrastination Scale, the NEO Five-Factor Inventory (NEO-FFI), and the Metacognitive Self-Regulation subscale of the Motivated Strategies for Learning Questionnaire (MSLQ).

Results: The regression model explained 18.5% of the variance in the dependent variable, $R^2 = 18.5\%$. A more conservative estimate, adjusted R^2 , indicated that 14.7% of the variance is explained by the model. This adjusted value accounts for the number of predictors, providing a more accurate representation of the model's generalizability and explanatory power.

Conclusion: These findings provide new evidence that certain metacognitive processes, which are usually thought to be adaptive, can result in procrastination when coupled with emotional instability. The study accordingly underlines the need to design interventions that improve efficient metacognitive functioning and emotional regulation, particularly for students scoring high in neuroticism or low in conscientiousness.

Keywords: Predicting Academic Procrastination; Metacognitive Self-Regulation; Personality Traits; Conscientiousness; Neuroticism; Higher education.

Introduction

Recognizing the reasons behind why people frequently fail to complete academic and professional tasks on time has been considered entirely as the focus in psychology and educational procrastination (Olleras et al., 2022). Researchers point out that procrastination is a universal phenomenon that acts as a deliberate action in postponing activities in life, particularly in the academic arena (Jayalakshmi & Punithavalli, 2024). Due to low psychological factors like self-efficacy, affective states like shame and guilt, one's characteristics like dependence, locus of control that includes both intrinsic and extrinsic motivation, control system, role conflict, social activities, personality traits, and self-regulation, procrastination has been the subject of numerous studies (Bibi et al., 2023), (Feyzi Behnagh & Ferrari, 2022). Clinical procrastination is seen to be a minor problem; however, it is a widespread phenomenon that may result in depression and psychological problems. Within an achievement-oriented society, when individuals experience paramount change and are obliged to move along with developments, then procrastination may become a serious problem, especially in an academic setting (Snehitha et al., 2021). According to Fentaw et al. about 80% of the students procrastinate to varying degrees, with half consistently due to stress, laziness, poor time management, and a lack of planning for academic tasks; thus, academic procrastination is the most common behavioral problem that students experience in schools (Fentaw et al., 2022). Writing term papers, preparing for tests, reading assignments, and completing academic and administrative tasks, and attending tasks are just a few of the various tasks that students must complete in academic contexts. However, the execution of these activities is frequently delayed for various reasons (Ahmed et al., 2023). Any student who intentionally delays studying until the night before a test indulges in academic procrastination, which has an impact on their academic performance, including poorer grades, more stress, and an overall decrease in self-esteem (Kufiyak, 2022).

Kagan et al. experimented with 265 students from various universities, departments, and classes, and it was found that among students with individual characteristics of perfectionism and compulsive obsession, 25% of them manifested some degree of academic procrastination, which disrupted their learning processes (Kağan et al., 2010). Even though procrastination is highly widespread among students, it is not well understood what its psychological foundations are. In addition to low academic performance, procrastination is characterized by negative emotional consequences, such as guilt, anxiety, and sorrow (Choi, 2021). It is crucial to understand the reasons for this behavior to inform effective interventions that might improve student learning outcomes. However, the relationship with procrastination is generally consistent across several important factors that have been explored in studies, particularly those related to self-regulated learning behavior (Svartdal et al., 2022). As stated, academic procrastination refers to intentional, deliberate behavior. In Kaur et al.'s study, Self-regulation has been said to form the very basis of all causal processes and the genesis of intentional behavior. Some of its integral elements are self-monitoring of one's behavior and evaluating the consequences of the same. Metacognitive self-regulation is a subcategory of self-regulation (Kaur et al., 2018). That is to say, a closely related concept to procrastination as intentional behavior is metacognitive self-regulation, which refers to the capacity to control an individual's thought processes to improve educational outcomes (Zhou et al.,

2022a). According to Ambaryani and Putranta, there is evidence that metacognitive strategies, such as planning, monitoring, and evaluating learning procedures, minimize procrastination (Ambaryani & Putranta, 2022). Also, as Zimmerman et al. stated since Self-regulation in academic settings involve setting goals, tracking progress, and adjusting strategy to optimize learning (Zimmerman et al., 2023), it serves as one of the most important theoretical frameworks for making sense of academic procrastination, which describes people's capability to manage their emotional, behavioral, and cognitive processes to achieve long-term goals (Zhou et al., 2022b). According to Ragusa et al. students with poorer self-regulation are more likely to procrastinate because they find it difficult to handle the demands of their studies and manage time effectively (Ragusa et al., 2023). Deng et al. stated that Students who more actively practice metacognitive self-regulation appear to be better at managing academic tasks and thereby reduce tendencies to procrastinate; in turn, this reduces emotional distraction (Deng et al., 2024). It may be helpful to foster metacognitive capability in learning environments as a means to reduce procrastination and improve academic achievement (Safari & Yousefpoor, 2022). Effective self-regulation, with the use of metacognitive methods, can enable individuals to control their behavior, monitor their activities, and adjust their performance as necessary to achieve foreordained goals (Zimmerman, 2023). Imposed on students, the concepts of metacognitive self-regulation can empower self-regulated learners in selecting a suitable learning strategy, paying attention to their learning process, and if needed, changing their behavior or learning strategy. Academic achievement has been identified as highly predicted by metacognitive self-regulation (Pucillo & Perez, 2023). Apart from self-regulation and metacognition, individual differences in personality traits are considered important factors that determine procrastination. Many researchers consider personality as the active configuration of a person's unique pattern of motivations, perceptions, physical makeup, physiological processes, and behavioral systems through interacting with their environment, as well as their thinking, feeling, reacting, and interpreting their experiences (Cervone & Pervin, 2022). Personality generally influences these patterns, although these patterns may vary from one individual to another; they generally reflect consistent and describable lifestyles (Zhao et al., 2024). Therefore, personality consists of enduring mental and behavioral attributes that allow individuals to express themselves (Cervone & Pervin, 2022) and relates to performance in various behavioral, emotional, and cognitive domains. In regard to the Five-Factor Model of Personality, the major personality traits related to procrastination tendencies are Extraversion (E), Conscientiousness (C), Agreeableness (A), Openness to new Experiences (OE), and Neuroticism (N) (Ocansey et al., 2022). By definition, according to Singh and Bala, procrastination is negatively related to Conscientiousness, characterized by responsibility, organization, and goal orientation. Individuals scoring high in C are usually more disciplined and avoid delaying their schoolwork (Singh & Bala, 2020; Berinšterová et al., 2021). Contrarily, procrastination is positively associated with Neuroticism, described as tendencies toward worry, emotional instability, and stress sensitivity. According to Yang et al., students who experience high Neuroticism may delay their assignments because of anxiety and self-doubt, which then leads them not to focus or participate in academic work (Yang et al., 2025; Mayer, 2017). On the other

hand, Openness to Experience has been related in a mixed manner to procrastination. Some studies have found that those who are more open may procrastinate less, while others claim this trait can be related to procrastination due to the distractibility associated with creative thought. The relationship between personality traits and procrastination is complex, and how these traits may interact with other psychological factors, such as self-regulation and metacognition, definitely needs further investigation (Begum, 2025). According to Ragusa et al, academic stress and anxiety were positively connected with procrastination, while self-regulation indirectly enhanced performance by reducing procrastination. Self-Regulated Learning (SRL) techniques in secondary school, such as metacognition and self-efficacy, not only lighten procrastination but also mitigate its negative impacts on academic achievement and well-being (Ragusa et al., 2023). As Shi et al. stated in their study, procrastination was positively predicted by metacognitive methods, indicating intricate relationships between SRL and delaying action (Shi et al., 2024). Sparfeldt and Schwabe, in their findings, demonstrated that academic procrastination mediates the association between academic achievement and conscientiousness (Sparfeldt & Schwabe, 2024). Similarly, Chen et al. have stated that conscientiousness was the best Big Five predictor of academic achievement, that interestingly, N showed a positive connection among first- and second-year students, suggesting a complex role (Chen et al., 2025). B  ulke et al. used cluster analysis in an empirical study that demonstrated procrastination has a negative correlation with Conscientiousness and a positive correlation with Neuroticism (B  ulke et al., 2021). Kooren et al. distinguished between active and passive procrastination, stating that not all procrastination is maladaptive. Active procrastination had a slight positive effect on academic achievement, whereas passive procrastination was negatively correlated with performance (Kooren et al., 2024).

Given the pervasiveness of academic procrastination and its detrimental impacts on students' academic performance and well-being, recognizing and understanding the psychological elements that contribute to procrastination is crucial. Despite previous research looking into the separate influences of self-regulation and personality traits on procrastination, few studies have examined the conjoint effects of metacognitive self-regulation and personality factors on academic procrastination. Therefore, to fill this gap, the present study investigates how personality factors and metacognitive techniques predict students' procrastination.

The present research seeks to contribute to the understanding of how metacognitive self-regulation and personality factors together and separately relate to students' proneness for academic procrastination. More particularly, by combining ideas about metacognitive self-regulation and personality traits, it examines the extent to which procrastination is related to self-regulation techniques and motivational beliefs, and in what ways personality traits as N, C, E, OE, and A, play a role in such behavior. Guided by the general hypothesis that metacognitive self-regulation and personality factors are strong determinants of academic procrastination, this research investigates specific theories relating each of these psychological components to students' proneness to delay academic activities. This study will further add to the existing body of research on academic procrastination by providing a deeper look into the psychological elements that influence

procrastination. The results and understanding of how personality traits and metacognitive self-regulation interact could, therefore, guide the design of focused therapies that reduce procrastination. Encouraging self-regulation may also help students overcome procrastination and achieve academic success.

Methodology

To investigate the predictive relationships among academic procrastination, the five major personality traits, and metacognitive self-regulation, the present study employed a descriptive-correlational methodology. Academic procrastination is the criterion variable in this analytic framework, while personality traits and metacognitive self-regulation techniques are the predictor variables. The target population of this study consisted of university students enrolled during the 2023–2024 academic year at three selected universities located in Ardabil city, Iran: Payam Noor University, Islamic Azad University, and Mohaghegh Ardabili University. Although these institutions are located in Ardabil Province, the sampling frame was limited to students from these three universities in Ardabil city; therefore, the findings should be interpreted with consideration of their limited generalizability to all university students across Ardabil Province.

A convenience sampling technique was used to recruit participants from the selected universities. A total of 200 students were initially invited to participate in the study, and 185 completed questionnaires were considered suitable for final analysis. The required sample size was estimated based on recommendations for multiple regression analyses, suggesting approximately 15–30 participants per predictor variable. With six predictors included in the regression model (five personality traits and metacognitive self-regulation), a minimum sample size of 180 participants was considered adequate for conducting the planned analyses.

The study aimed to examine the contribution of personality factors and metacognitive self-regulation to academic procrastination among students enrolled at the three selected universities in Ardabil city. Before data collection, an introductory letter and the necessary authorization were obtained from Payam Noor University. Additional approval letters required for participant recruitment and data collection were prepared and endorsed by the relevant educational and administrative departments of the participating universities. Before completing the questionnaires, participants were informed about the purpose of the study, the rationale for selecting the instruments, and the research procedures. Participation was voluntary, and students were informed that they could withdraw from the study at any stage without consequence. Instructions for completing the questionnaires were provided, and participants were encouraged to contact the researchers if they experienced any difficulties during the data collection process.

The data collection tools in this research consisted of questionnaires, including Metacognitive Self-Regulation Learning Strategies (MSLQ), NEO Five-Factor Personality Inventory (FFI), and Academic Procrastination Questionnaire.

Metacognitive Self-Regulation Learning Strategies: A scale developed using the Motivated Strategies for Learning Questionnaire (MSLQ), designed by Pintrich & De

Groot in 1990, was used for metacognitive self-regulation. The scale assesses both motivational beliefs, like self-efficacy, intrinsic value, goal orientation, and test anxiety, and cognitive and metacognitive strategic learning techniques (Marrucci, 2022). The scale used in this study uses a Likert-type scale with a score range of 5 points and a total of 47 items into two subscales: motivational beliefs and self-regulation learning practices. The factorial validity test has been conducted using Factor Analysis to test the original scale (Pintrich & De Groot, 1990). With Cronbach alpha coefficients of .83 for the cognitive strategy scale and .74 for the metacognitive self-regulation scale, with total scale reliability above .95 for the overall Iranian sample data, Persian versions are well-accepted and have high levels of internal consistency for the scale (Madad Pour et al., 2016). The application of the self-regulation scale among Iranian educational groups has been noted with Aeen Mohammadia et al. in 2022, with higher levels of reliability to be measurable for self-regulation and an improvement in self-regulated learning practices after application (Mohammadi et al., 2022). With a focus on self-regulation concepts for the Emotion and Motivation Scaling Questionnaire for Persian culture- EM- SR- Q, with a link for the metacognitive self-regulation scale and a total score for self-regulation for Iranian sample data applicability; Cronbach alpha levels range between .71 & .86 as noted in a study by Norouzi et al. in 2022 (Norouzi et al., 2022). In this study, the internal consistency reliability of the Motivated Strategies for Learning Questionnaire (MSLQ) demonstrated good reliability with $\alpha=.841$.

NEO-Five-Factor Personality Inventory: This inventory was constructed in 1985 by McCrae and Costa, with Extraversion (E), Agreeableness (A), Openness to Experience (O), Conscientiousness (C), and Neuroticism (N) as the five characteristics in its original version, comprising 240 items. Each factor has six sub-traits (Bayat et al., 2021; Sanz-García et al., 2024). In 2002, Michael Bironbuss constructed the short form (60-item) used in the present investigation, with the same objectives as the extended version. The extended and short forms did not differ considerably in validity or reliability. Responses are given using a 5-point Likert scale, ranging from 0 (strongly disagree) to 4 (strongly agree). Azakhosh and Asgary (2014) reported satisfactory construct validity and reliability results on most categories in a psychometric study of the Persian NEO-FFI in a large sample of Tehran (see the full article) (Azakhosh & Asgary, 2014). In Iran, in the study by Atashrooz (2007), using the internal consistency method, Cronbach's alpha coefficients for each of the five traits—neuroticism, extraversion, openness, agreeableness, and conscientiousness—were 0.74, 0.55, 0.27, 0.38, and 0.77, respectively (Atashrooz, 2007). In the current research, the NEO Five-Factor Inventory (NEO-FFI) showed acceptable reliability ($\alpha = .723$).

Academic Procrastination Questionnaire: This scale, was created by Solomon and Rothblum, was used to gauge academic procrastination (Solomon & Rothblum, 1988). It contains questions to measure procrastination in various forms of academic activities, such as the writing of term papers, preparation for exams, and preparation of assignments. The scale also contains questions to measure discomfort and motivation to change procrastination, as well as its frequency of occurrence. The reliability of this scale,

measured by Cronbach's alpha in Solomon's (1998) study, was 0.64. The 27-item academic procrastination scale takes a 5-point Likert scale format (1=never to 5=always). The Iranian version of the has been shown to have acceptable levels of psychometric properties among Iranian students. In several Iranian validation studies, there are indications of good factor and internal consistency properties, as indicated by validation studies that showed a Cronbach's α between 0.78 and 0.87 (Mortazavi et al., 2015). The Iranian validation study conducted by Ghasempour et al. for medical students also showed that the PASS has good properties, indicated by a Cronbach's α of 0.85 for the Iranian PASS. In their study among medical students of one of Iran's major universities, Ghasempour et al. mentioned that studies done in Iran, conducted by Roshanzadeh et al. 2021 indicated that α was practically around 0.87 for the Iranian scale (Ghasempour et al., 2024). Also, in the current research study, the Academic Procrastination Scale yielded a lower reliability estimate as $\alpha=.566$.

Data Analysis

The collected data were analyzed using the Statistical Package for the Social Sciences (IBM SPSS Statistics, Version 26.0). Descriptive statistics, including means, standard deviations, frequencies, and percentages, were calculated to summarize participants' demographic characteristics and the study variables. Pearson's correlation coefficients were conducted to examine the relationships among academic procrastination, the five personality traits (neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness), and metacognitive self-regulation.

To examine the predictive contribution of personality traits and metacognitive self-regulation to academic procrastination, a multiple linear regression analysis was conducted. The simultaneous method was selected because all predictor variables were entered into the regression model simultaneously based on the theoretical framework of the study rather than being selected according to statistical criteria. Academic procrastination was entered as the dependent variable, while the five personality dimensions and metacognitive self-regulation were entered as predictor variables.

Before conducting the regression analysis, the assumptions of multiple linear regression were evaluated. The normality of residuals was examined. Multicollinearity among predictor variables was assessed using tolerance values and Variance Inflation Factor (VIF) statistics. Independence of errors was evaluated using the Durbin-Watson statistic, and homoscedasticity was assessed through examination of standardized residuals. The assumptions were considered satisfied when diagnostic values fell within acceptable ranges, allowing the regression analysis to be interpreted reliably.

The internal consistency reliability of the instruments was assessed using Cronbach's alpha coefficients. In the current sample, the Motivated Strategies for Learning Questionnaire (MSLQ) demonstrated good reliability ($\alpha = .841$), the NEO Five-Factor Inventory (NEO-FFI) showed acceptable reliability ($\alpha = .723$), and the Academic Procrastination Scale yielded a reliability coefficient of $\alpha = .566$.

Findings

Table 1 reflects the demographic data and findings of the proposed study. The demographic statistics demonstrated that a total of 181 participants took part in the study. 41.4% of the participants in this sample were men, and 58.6% were women. This shows that the percentage of female participants is marginally higher in this population of the study. Even though participants were selected from various universities, the largest chunk of the sample consisted of Mohaghegh Ardabili University of Ardabil city (40.7%). Payam Noor University came second with 36.3% participants, while Islamic Azad University trailed at 21.4%. All other institutions had hardly any representation; only 0.5% classified his/her institution as "Other." The majority of the participants are from Mohaghegh Ardabili. Overall, the demographic profile reflects a predominantly female sample.

Table 1. Distribution of participants by gender and university.

Variable	Options	Frequency	Percentage
Gender	Female	106	58.6%
	Male	75	41.4%
University	Islamic Azad University	39	21.4%
	Mohaghegh Ardabili University	74	40.7%
	Payam Noor University	66	36.3%
	Other	1	0.5%

According to the results of the Distribution of Participants by Age and Grade Point Average (GPA), the students' average age was 22.71 years (± 6.64 years), and their average GPA was 16.66 (± 1.74).

The descriptive statistics to find out the prevalence or level of the research variables are presented in Table 2. The results indicated that the psychological characteristics, learning methods, and academic habits of individuals differed. In summary, the mean score for motivational beliefs was relatively high at 88.84, which meant that the students had a very high motivation to pursue their academic goals. Their mean score of 50.05 indicated a moderate use of cognitive strategies, and their mean score of 29.96 indicated a moderate use of metacognitive strategies, which are skills linked to planning, monitoring, and regulating learning. As for personality traits, the sample's mean score in neuroticism was 25.44, indicating an appreciable level of emotional instability or a stress-prone tendency.

Table 2. Mean and Standard Deviation (SD) of the research variables.

Variable	Mean	Standard Deviation
Motivational Beliefs	88.84	13.00
Cognitive Strategies	50.05	8.35
Metacognitive Strategies	29.96	6.44
Neuroticism	25.44	7.28
Extraversion	20.46	6.69
Openness to Experience	20.53	5.27
Agreeableness	20.24	6.15
Conscientiousness	15.69	8.53
Academic Procrastination	70.78	8.61

The moderate levels of extraversion at 20.46, openness to experience at 20.53, and agreeableness at 20.24 indicate a balanced disposition for interpersonal harmony, curiosity, and social involvement. Conscientiousness scores are relatively lower compared to other traits, at 15.69, indicating inadequate levels of organization, accountability, or self-control. The mean score for academic procrastination was 70.78, which is comparatively high. This would suggest that despite strong motivational beliefs, many individuals had difficulty delaying academic assignments. Put together with reduced conscientiousness and only moderate use of self-regulatory strategies, these findings suggest a pattern whereby students may feel motivated but often lack consistent strategic or personality-based supports to transfer the motivation into timely academic activity. Overall, the results indicate a motivated yet procrastinating sample of students, possibly influenced by high neuroticism, low conscientiousness, and moderate engagement in self-regulatory strategies.

The correlation analysis in Table 3 revealed several theoretically coherent relationships among study variables. Based on the results, motivation was strongly and positively correlated with cognitive strategies, with an r of 0.571, and moderately with metacognitive strategies, with an r of 0.287, while cognitive and metacognitive strategies were also positively correlated, r of 0.394. Conscientiousness revealed the strongest positive correlations with learning variables: motivation with an r of 0.282; cognitive strategies with an r of 0.395; metacognitive strategies with an r of 0.210, emphasizing its central role in structured, objective-oriented, and self-regulated learning. Neuroticism showed a weak negative correlation with motivation, achieving an r of -0.049 , and with cognitive strategies with an r of -0.209 , while extraversion, openness, and agreeableness had small, mainly positive correlations with learning strategies.

Regarding motivation, cognitive strategies, and metacognitive strategies, academic procrastination had significant negative correlations with motivation (r of -0.169), cognitive strategies (r of -0.155), and metacognitive strategies (r of -0.291). These results all indicate that learners who demonstrate diminished motivation and ineffective self-regulation strategies are more susceptible to academic procrastination and support the associated hypotheses about motivational beliefs and self-regulation. Conscientiousness was also found to have a significant negative correlation with academic procrastination, with an r of -0.203 , showing that higher conscientiousness seems to be associated with low levels of procrastination. Neuroticism also correlated negatively with procrastination (r of -0.167), albeit with a small effect. Extraversion with r of -0.079 , openness to experience with an r of -0.109 , and agreeableness with an r of -0.072 were found to present small and insignificant negative correlations, thus providing little support for the associations of each with procrastination. The overall findings indicate that motivational beliefs, cognitive and metacognitive strategies, and conscientiousness might be the most strongly linked factors with academic procrastination. Taken as a whole, the trend of results favors the hypothesis that metacognitive self-regulation processes and basic personality traits, particularly conscientiousness, play very important roles in students' procrastination tendencies.

Table 3. Correlation Matrix of the Research Variables.

Variable	Motivation	Cognitive Strategies	Metacognitive Strategies	N	E	O	A	C	Academic Procrastination
Motivation	1								
Cognitive Strategies	0.571	1							
Metacognitive Strategies	0.287	0.394	1						
N	-0.049	-0.209	-0.005	1					
E	0.075	*0.187	0.089	-0.260	1				
O	*0.159	0.234	0.033	-0.066	0.058	1			
A	0.142	0.338	0.126	0.107	-0.403	0.033	1		
C	0.282	0.395	0.210	-0.328	-0.436	-0.11	-0.418	1	
Academic Procrastination	-0.169*	-0.155*	-0.291	*-0.167	-0.079	-0.109	-0.072	-0.203	1

p (*p < .05, **p < .01).

The assumptions for regression analysis, namely normality of data distribution, multicollinearity, and independence of residuals, were satisfied as shown in Table 4. The assumptions of normality, multicollinearity, and independence of residuals were validated before the performance of regression analysis. The application of parametric regression methods is justified using the results of the Kolmogorov-Smirnov test, which indicated that there were no significant deviations of the predictor variables from normality ($p = .45-.63$). The multicollinearity assumption was satisfied, as all predictor variables had tolerance values above 0.10 and VIF values below 5. The results showed multicollinearity diagnostic statistics with tolerance levels between .614 and .865 and Variance Inflation

Factors (VIFs) between 1.155 and 1.628. The diagnosis showed minimal levels with indications that the independent variables were not highly correlated with each other and could provide reliable interpretability for regression coefficients. The Durbin-Watson statistic for the model with a value of 1.84 indicated that the assumption of independence of residuals was satisfied, as the value was close to 2.

Table 4. Results of Regression Assumptions Test

Predictor Variable	Kolmogorov-Smirnov Test	Multicollinearity	Durbin-Watson Test
Motivational Beliefs	0.63	Tolerance: 0.628, VIF: 1.593	1.84
Metacognitive Strategies	0.45	Tolerance: 0.794, VIF: 1.260	
Cognitive Strategies	0.55	Tolerance: 0.770, VIF: 1.299	
Neuroticism	0.53	Tolerance: 0.647, VIF: 1.545	
Extraversion	0.61	Tolerance: 0.865, VIF: 1.155	
Openness to Experience	0.61	Tolerance: 0.704, VIF: 1.421	
Agreeableness	0.58	Tolerance: 0.614, VIF: 1.628	
Conscientiousness	0.60	Tolerance: 0.628, VIF: 1.593	

ANOVA is used to assess whether group means differ statistically significantly or, in the case of regression, whether a significant amount of the variance in the dependent variable can be explained by the overall model. While the p-value tells the probability that the observed effect occurred by chance, with $p < .05$ generally considered statistically significant, the F-statistic measures the ratio of variance accounted for by the model compared to variance not accounted for (error), with higher values reflecting a better fit of the model to the data. The predictive effects of the eight independent variables on the dependent variable were examined using a regression analysis. The ANOVA results in Table 5 also indicates that the overall regression model is statistically significant. The model explains a significant portion of the variance in the dependent variable, as evidenced by the F-statistic of 4.799 and a highly significant p-value of 0.0001 (which is less than the conventional alpha level of 0.05). Specifically, the regression component accounts for 2383.571 units of the total sum of squares, with 8 degrees of freedom. The residual component, representing unexplained variance, has a sum of squares of 10491.713 with 169 degrees of freedom. The mean square for regression is 297.94, and the mean square for residuals is 62.08, yielding the F-statistic. This statistically significant result suggests that the independent variables included in the model collectively contribute meaningfully to predicting the dependent variable. The regression model

explained a modest proportion of the variance in the dependent variable, with $R^2=18.5\%$ and adjusted $R^2=14.7\%$. The adjusted R^2 , which accounts for the number of predictors and provides a more conservative estimate of model fit, indicates that the model's explanatory power is limited but meaningful.

Thus, the model of multiple regression demonstrated statistical significance, indicating that motivational beliefs, metacognitive strategies, cognitive strategies, and personality traits together accounted for a significant proportion of variance in the outcome variable.

Table 5. ANOVA for the Regression Model

Source	Sum of Squares	Degrees of Freedom	Mean Square	F-Statistic	Significance
Regression	2383.571	8	297.94	4.799	0.0001
Residuals	10491.713	169	62.08		
Total	12875.287	177			

From Table 6, it appears that multiple regression analysis indicated that neuroticism ($\beta=.233$, $t=2.95$, $p=.004$), metacognitive strategies ($\beta=.257$, $t=3.29$, $p=.001$), were positively significant predictors of academic procrastination, while conscientiousness ($\beta=-.211$, $t=-2.38$, $p=.019$) was significantly negatively related to it. This indicates that, for students who tended towards neuroticism or metacognitive strategies, there was also higher reported procrastination. For others, being more conscientious meant having lower tendencies towards procrastination. While they were not close to significance in this analysis, variables such as agreeableness, extraversion, openness to experiences, beliefs, or cognitive approaches added more towards understanding this regression analysis. These findings highlight in a subtle manner how more complex interactions exist between every individual's personality traits, cognitive/motivational processes, to more complicated acts of procrastinatory behavior. Rather ironically, it appears that neuroticism or certain control strategies can be additional elements that can trigger higher level of procrastination, when probably it should decrease it, while being more conscientious acts as an antidote for it. On an overall basis, these findings emphasize once again certain crucial affects/self-regulatory aspects underlying larger understanding of academic procrastination, in this manner that truly disjointedly exist comprehensive aspects of various traits, cognitive/motivational processes.

Table 6. Standardized Regression Coefficients.

Predictor	Unstandardized β	Standardized β	t-value	p-value
Constant	76.438		11.33	0.000
Motivational Beliefs	0.32	0.048	0.56	0.577
Cognitive Strategies	0.30	0.003	0.03	0.976
Metacognitive Strategies	0.336	0.257	3.29	0.001

Neuroticism	0.270	0.233	2.95	0.004
Extraversion	-1.09	0.087	1.05	0.316
Openness to Experience	-0.156	0.097	-1.30	0.195
Agreeableness	-0.045	-0.033	-0.39	0.695
Conscientiousness	-0.209	-0.211	-2.38	0.019

The results show that metacognitive strategies, neuroticism, and conscientiousness are significant predictors of academic procrastination, with metacognitive strategies and neuroticism having a positive effect, and conscientiousness having a negative effect.

Discussion

The present study examined the extent to which personality traits and metacognitive self-regulation contribute to the prediction of academic procrastination among higher education students. The findings demonstrated significant relationships between self-regulatory processes and procrastination behavior, indicating that students with stronger motivational beliefs, more effective cognitive learning strategies, and greater use of metacognitive strategies were less likely to engage in academic procrastination. These results highlight the critical role of self-regulation in students' ability to initiate, monitor, and complete academic tasks in a timely manner.

The negative association between metacognitive self-regulation and academic procrastination suggests that students who actively plan, monitor, and evaluate their learning activities are better able to control task-related behaviors and overcome tendencies to delay academic responsibilities. This finding is consistent with the self-regulated learning framework, which proposes that successful learners engage in goal setting, strategic planning, self-monitoring, and self-reflection to regulate their academic performance. Students with well-developed metacognitive skills are more likely to recognize ineffective study patterns, adjust their strategies, and maintain persistence when encountering difficult academic demands. The findings further indicated that motivational beliefs, cognitive strategies, and metacognitive strategies were negatively associated with academic procrastination. This suggests that students who possess stronger academic confidence, perceive greater value in learning activities, and employ effective cognitive approaches are less likely to postpone academic tasks. Motivation may function as an important protective factor because students who believe in their ability to succeed are more likely to approach challenging tasks rather than avoid them. In contrast, students with weak motivational beliefs may experience reduced task engagement, lower persistence, and increased avoidance behaviors, which subsequently contribute to procrastination.

Conversely, the positive association between neuroticism and academic procrastination suggests that emotional instability and increased vulnerability to stress may contribute to avoidance-based academic behaviors. Students with higher levels of neuroticism may experience greater anxiety, fear of failure, and negative emotional responses when facing demanding academic tasks. As a result, postponing these tasks may temporarily reduce emotional discomfort, reinforcing procrastination as a maladaptive coping strategy. This

explanation is consistent with previous evidence indicating that procrastination is closely related to emotion regulation difficulties and attempts to avoid negative affect (Pychyl & Sirois, 2016).

This study investigated the predictors of academic performance, with a particular focus on metacognitive strategies and personality traits. The regression analysis revealed significant relationships between several variables and the dependent measure ($t = 11.33$, $p < 0.001$, $t = 11.33$, $p < 0.001$).

Regarding significant predictors, metacognitive strategies demonstrated a notable positive relationship with academic performance ($\beta = 0.257$, $t = 3.29$, $p = 0.001$). This aligns with established literature underscoring the critical role of self-regulated learning in academic success, as studies consistently demonstrate that students who effectively employ metacognitive strategies, such as planning, monitoring, and evaluating their learning, tend to achieve higher academic outcomes (Zimmerman, 2002; Pintrich & De Groot, 1990). Consequently, our findings suggest that the proficient use of these strategies is a robust predictor of performance within this sample. Neuroticism also emerged as a significant positive predictor ($\beta = 0.233$, $t = 2.95$, $p = 0.004$). While counterintuitive at first glance, this finding may indicate that students higher in neuroticism—characterized by tendencies toward anxiety and worry—might engage in more effortful learning behaviors or seek additional external validation, which could inadvertently boost their performance in certain academic contexts. It remains crucial, however, to interpret this finding cautiously, as higher neuroticism is more commonly associated with negative academic behaviors like procrastination (Sirois & Pychyl, 2016). The literature suggests that while neuroticism can be linked to academic outcomes, its effect is often mediated by other factors such as self-regulation and emotional intelligence (Kafash & Al-Kassir, 2023), indicating that further research is required.

In contrast to the expected outcomes, conscientiousness significantly predicted academic performance negatively ($\beta = -0.211$, $t = -2.38$, $p = 0.019$). This is a significant deviation from the broader literature, where conscientiousness is almost universally recognized as a strong positive predictor of academic success, primarily due to its association with diligence, organization, and goal-directed behavior (Ozer & Benet-Martínez, 2006). This negative association warrants careful consideration. Potential explanations include the possibility that this specific sample possesses unique characteristics where high conscientiousness is channeled into activities unrelated to the measured academic performance, or that it correlates with a level of over-effort that leads to burnout. Furthermore, issues regarding the specific scales used to measure conscientiousness or academic performance in this population, or the presence of unmeasured mediating variables, may also be obscuring the expected link. For instance, it is plausible that highly conscientious students in this sample were more prone to maladaptive perfectionism, leading to excessive time spent on tasks without achieving proportional performance gains.

Beyond these significant predictors, several variables—including motivational beliefs ($p = 0.577$), cognitive strategies ($p = 0.976$), extraversion ($p = 0.316$), openness to experience ($p = 0.195$), and agreeableness ($p = 0.695$)—did not show statistically significant relationships with academic performance. This result might suggest that metacognitive

control over cognitive strategies is more influential than the underlying strategies themselves in this specific context, or that the impact of cognitive strategies is simply overshadowed by stronger predictors such as metacognition and neuroticism.

The significant positive finding for metacognitive strategies reinforces their importance in educational interventions, suggesting that educators should focus on explicitly teaching and fostering metacognitive skills by emphasizing planning, self-monitoring, and strategy evaluation. Furthermore, the unexpected negative association with conscientiousness highlights a clear need for further investigation. Future research should employ longitudinal designs to track how conscientiousness influences academic performance over time and explore potential mediating or moderating factors, such as perfectionism or specific learning environments. Qualitative studies could also provide deeper insights into why high conscientiousness might not translate into higher performance in certain contexts. Finally, exploring the nuanced role of neuroticism, particularly its potential for driving effort despite associated anxiety, is recommended, ideally through studies that incorporate measures of self-efficacy and various coping mechanisms.

The absence of significant relationships between academic procrastination and the personality dimensions of openness, agreeableness, and extraversion should also be considered. Although previous studies have reported mixed findings regarding these traits, their weaker association with procrastination compared with conscientiousness and neuroticism may reflect the more direct relevance of self-discipline and emotional regulation to task delay behaviors. The lack of significant effects may also be influenced by characteristics of the current sample, cultural context, academic discipline, or limitations related to measurement sensitivity.

Overall, the findings indicate that academic procrastination among university students is a multifaceted phenomenon influenced by both personality characteristics and self-regulatory processes. While personality traits such as conscientiousness and neuroticism represent relatively stable individual differences, metacognitive self-regulation represents a potentially modifiable psychological skill. Therefore, interventions aimed at reducing academic procrastination may benefit from focusing not only on time-management training but also on developing students' metacognitive awareness, goal-setting abilities, emotional regulation skills, and adaptive motivational beliefs.

Conclusion

Taken together, the findings indicate the importance of metacognitive self-regulation and personality factors for understanding academic procrastination. While students high in neuroticism may be particularly prone to maladaptive delay behaviors, individuals who exhibit excellent metacognitive capabilities and who are conscientious appear less likely to procrastinate.

This study's findings should be interpreted with caution due to several limitations. Firstly, the use of convenience sampling restricts the generalizability of the results, as the sample may not be representative of the broader student population. Secondly, the sample's homogeneity—being drawn from a specific social group, age range, and educational background—further constrains the applicability of the findings. Additionally, the cross-sectional design does not allow for causal inferences to be made. Self-report biases

inherent in questionnaire-based data collection may also influence the results, as participants might over- or under-report certain behaviors or traits. Finally, the sample predominantly originating from a single university limits the external validity of the study.

Research Suggestions

It is recommended that future research replicate this study in diverse geographical regions and with broader, more representative populations to enhance the generalizability of the findings.

Future research could explore the relationships between metacognitive strategies and academic outcomes by including other relevant psychological variables among student populations.

To understand the dynamic interplay between metacognitive strategies and academic success over time, longitudinal designs are recommended. This approach would allow researchers to track changes and establish temporal relationships.

Practical Suggestions for Educators

Considering the increasing demand for higher education and the importance of developing a highly skilled generation, it is recommended that educational institutions and mental health professionals develop and implement targeted programs. These programs should focus on teaching students effective and context-specific strategies to reduce academic procrastination and enhance academic productivity. Educators should be mindful that not all metacognitive strategies may be universally beneficial; therefore, training should emphasize adaptive strategy use.

Educators should be aware that the mere knowledge of metacognitive strategies does not guarantee their effective application. There may be a gap between understanding a strategy and successfully implementing it in a way that improves performance. Therefore, educators should not only teach these strategies but also provide opportunities for guided practice, feedback, and reflection on their use. This could involve helping students identify when and why certain strategies are more or less effective for them personally, thus addressing the potential “backfiring” of metacognitive approaches.

It is suggested that through awareness-raising initiatives, students be encouraged to understand their individual strengths and weaknesses in learning. This self-awareness is crucial for them to select and adapt metacognitive strategies that best suit their learning style and the demands of specific academic tasks. Educators can facilitate this by fostering a classroom environment that encourages experimentation, reflection, and personalized learning approaches.

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