Variables cognitivas y afectivas predictivas del rendimiento académico del alumnado universitario

Cognitive and affective variables predictive of the academic performance of university students

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RESUMEN.
La afectividad en el contexto educativo ha cobrado importancia porque se reconoce que los estudiantes experimentan una variedad de emociones en el entorno académico. Este artículo busca explicar el impacto de variables cognitivas y afectivas específicamente, depresión, ansiedad y enojo en el rendimiento académico. El diseño fue un análisis de regresión múltiple que consideró las variables cognitivas, afectivas y el género como independientes y el índice académico como variable dependiente. Participaron 719 estudiantes de nuevo ingreso de una universidad dominicana. Los resultados evidencian que, a pesar de que el rendimiento académico podía ser explicado por la influencia de ambas variables, las cognitivas tuvieron un efecto hasta cinco veces mayor que las afectivas. Las variables afectivas que tuvieron valor predictivo fueron: el enojo, específicamente el control interno y la reacción de ira y la dimensión cognitiva-afectiva de la depresión. En las mujeres, las variables afectivas no fueron predictoras del rendimiento académico.

PALABRAS CLAVES.
Rendimiento académico, depresión, ansiedad, enojo.

ABSTRACT.
Affectivity in the educational context has gained importance because it is recognized that students experience a variety of emotions in the academic environment. This article seeks to explain the impact of cognitive and affective variables specifically depression, anxiety and anger on academic performance. The design was a multiple regression analysis that considered the cognitive and affective variables and gender as independent, and the academic GPA as the dependent variable. 719 new students from a Dominican university participated. The results show that, despite the fact that academic performance could be explained by the influence of both variables, the cognitive ones had an effect up to five times greater than the affective ones. The affective variables that had predictive value were anger, specifically internal control and anger reaction, and the cognitive-affective dimension of depression. In women, affective variables were not predictive of academic performance.

KEY WORDS.
Academic performance, depression, anxiety, anger.

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1. Introduction.

Despite many investigations have been carried out over time on the success or failure of students, the study of academic performance is still valid and updated in the scientific community. Academic performance is a complex phenomenon, since it is measured through quantitative characteristics, but it has a subjective dimension due to the endogenous and exogenous factors of the individual involved (Garbanzo, 2007). It involves personal elements such as skills, strategies and motivations and, at the same time, social issues such as family, demographic, institutional and didactic characteristics. Part of the complexity of its study is due to the fact that multiple definitions to the concept have been given to it. However, there seems to be a consensus when understanding academic performance as the way in which learning achieved by students is expressed during the teaching process, whether it is the result of teacher's didactic intervention or through self-learning (Lamas, 2015). Despite gradings are an institutional evaluation of learning products and do not refer so much to the achievement of deep and meaningful learning, they have been the most used method to measure it. Grades end up representing the achievements achieved as a result of a series of personal, academic and social variables that interact with each other.

1.1 Cognitive determinants of academic performance.

Intelligence and skills are probably one of the most studied variables in relation to academic performance. Aptitude tests measure cognitive abilities or thinking skills for the performance of a certain task; they do not measure the specific knowledge acquired but the capacity of the individual (Herrero et al, 2015). The application of this type of test as a requirement to enter the university system began in the United States at the end of the 19th century and was improved during the 20th century. The SAT test developed by the College Entrance Examination Board (CEEB) is well known. The North American model has been replicated in Latin America, and some countries have even decided to build their own tests, such as Chile (Manzi et al, 2010). Aptitude tests used to determine admission to higher education fundamentally evaluate mathematical and verbal reasoning; they aim to determine the ability of students to grasp, recognize, establish relationships and solve problems in these areas.

Results obtained by students in the aptitude tests applied during university admission process have shown that they are predictors of academic success (Garbanzo, 2007). Many studies have found that variables showing the most significant statistical correlations with academic performance are the scores obtained in these tests. A high score on entrance test becomes a protective factor while the percentage of failure, dropout and academic failure in a general sense are related to lower scores (Belloc et al., 2010; Montero et al., 2007; Rodrigo et al., 2012; Rojas et al., 2019; Rojas-Torres, 2013; Vázquez-Cano et al., 2017). Despite these results and the obvious contribution of intelligence to determine academic performance, the evident participation of different actors and the various personal and contextual elements involved have made it necessary to consider other factors. These factors make it possible to explain an additional percentage of the variance in addition to the purely cognitive ones, since multi-causality of this phenomenon cannot be denied.

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1.2 Affective variables in the academic context.

The study of affectivity in the educational context has gained importance because it is recognized that students experience a variety of emotions in the academic environment. The literature on this topic indicates that the affective structure is made up of two poles, one positive and the other negative (Flores and Medrano, 2016). These poles correspond to transitory states or relatively invariable personal dispositions capable of regulating emotional experiences. Positive affect is characterized by energy, optimism, and enthusiasm. While the negative pole is related to emotional discomfort, dissatisfaction, pessimism, nervousness, disgust, disinterest, sadness and anger (Robles and Páez, 2003). Ellis (2004) defends that healthy emotions, positive or negative are those that allow the successful achievement of goals through behavior adapted to the context as a result of a rational way of thinking. There are circumstances in which negative affections can potentially be adaptive, for example, in motivating students to achieve a goal, reducing errors, or recovering from a negative evaluation (Rowe and Fitness, 2018).

According to the World Health Organization (2021a), hereinafter WHO, depression is a mood disorder in which the person experiences sadness and guilt. The person experiences difficulties to enjoy, loss of self-confidence, inability to make decisions and concentrate. Depression has been associated with the presence of recurrent thoughts of death with suicidal ideation and / or suicide attempt. Since Beck's studies in the sixties, it has been identified that this disorder is produced by cognitive distortions that lead the person to make an unfavorable interpretation of reality; this interpretation has bodily and emotional consequences (García-Batista et al., 2018a). Hence, depression has a cognitive component; a somatic one and an affective one.

On the other hand, anxiety is defined as a disorder characterized by an excessive emotional reaction in which people experience intense and frequent fears and worries in everyday situations that are perceived as threatening (Tortella, 2014). Anxiety produces physiological and behavioral changes and feelings of uneasiness, tension, and apprehension.

Spielberger (1972) conceptualized anxiety as a state and a trait. He explained that state dimension is linked to situational issues, it is a transitory condition of the organism characterized by a feeling of tension. The state of anxiety is not permanent in time nor does it maintain the same intensity, it varies depending on the environment. While anxiety as a trait he considered it as a relatively stable personality characteristic that tends to perceive situations as threatening and therefore frequently produces the activation of the state of anxiety.

Annoyance or anger, as it is also often called in the Spanish language, is another of the emotions considered as part of negative affections. It is defined as an activation or tendency to attack that arises as a reaction to a threat, coercion, damage, frustration or differential treatment (Novaco, 2020). The term is often misunderstood with hostility and aggression, and they are used interchangeably; however, annoyance involves feelings of anger and resentment, unlike hostility which is an attitude and aggression which is an action (García-Batista et al.., 2018b).

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Spielberger (1991) indicated that like anxiety, annoyance has two dimensions: state and trait. The state defined as an emotion characterized by feelings of varying intensity ranging from irritation to anger and that is due to a situation at a particular moment. While trait is the relatively stable predisposition in time in which the person frequently perceives everyday situations as annoying or frustrating. Spielberg distinguishes three ways in which people can direct annoyance, internally, externally, or by controlling it. Internal direction refers to suppressing annoyance feelings, external to expressing them verbally or with aggressive behaviors towards other people or objects, and control implies mastering the feeling through calm.

In 2017, on the occasion of World Health Day WHO revealed that in the world there are more than 350 million cases diagnosed with depression, and more than 260 million have anxiety disorders; this represents 4.4% and 3.6% of the world population, respectively. The number of patients with depression has grown by 18% worldwide in the last decade, as well as anxiety disorders that have increased by 15% in the same period of time. Recently, the WHO (2021b) has expressed that mourning for economic, family and work losses and the confinement itself as a result of COVID-19 have aggravated mental health disorders; the pandemic has become a generator of new cases.

In university students, prevalence of anxiety and depression disorders is almost double that of the general population (Fernández-Rodríguez et al., 2019). Academic conditions, task overload, evaluations and time management turn out to be the main stressors associated with anxiety and depression (Balapala and Indla, 2017). Stress and anxiety affect students with physical, psychological and social symptoms. Students present tiredness, restlessness and irritability that sometimes leads them to isolate themselves or have conflicts with other students. The presence of these symptoms is detrimental to the quality of the cognitive processes involved in the acquisition of knowledge thus affecting their performance (Arce et al., 2020). Similarly, there is evidence that memorization process is influenced by high levels of stress, since being subjected to intense stressful situations impairs the ability of the hippocampus to store and retrieve information, a fundamental process for learning to occur (García et al., 2017).

Depression, in addition to affecting the feeling of well-being and its emotional cost has an effect on cognitive functions. Not only does it have a negative effect on memorization, but it impacts executive functions such as planning and decision-making. Depressed people experience difficulties to stop paying attention to a negative stimulus once it has been in their field of attention which causes a decrease in thought repertoires and the ability to concentrate on another task (Duque et al., 2015). This allows us to understand low performance and failure in learning achievements of students affected with depression despite having necessary aptitude conditions. Academic failure becomes a reinforcer of the irrational beliefs that sustain depression, plunging the student further into major depressive states. In this sense, depression is both a cause and an effect of poor academic performance.

The impact of other negative emotions on learning, such as annoyance, is less well known. Little has been found about its relationship to academic performance. At the university level, hours of sleep, evaluation periods and results of unfair or unrequited evaluations with the student's perception of the effort made tend to increase aggressiveness in students.

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Annoyance has been associated with poor academic performance and suicidal behaviors in university students (Demirbas and Gurcel, 2012). However, little is known about the impact of annoyance on performance and its effects on the cognitive processes involved in learning.

2.Material and Methods.

2.1 Design.

The design included 21 variables. A cross-sectional, field and correlational study was carried out. The main objective of this article was to determine the predictive capacity of cognitive and affective variables in the academic performance of university students. The hypotheses were the following:

H1: The BDI-II factors are predictors of academic performance.
H2: The STAXI-2 factors are predictors of academic performance.
H3: The STAI factors are predictors of academic performance.
H4: The PAA factors are predictors of academic performance.

2.2 Data collection instruments.

To study the elements that affect the academic performance of Dominican students, on the one hand three questionnaires were applied for affective variables: the Spanish adaptation of the State-Trait Anxiety Questionnaire (hereinafter STAI), carried out by Spilberger, Gorsuch, Lushene, Buela-Casal, Guillén-Riquelme and Seisdedos-Cubero, 2011), the Spanish adaptation carried out by Beck, Steer, Brown, Sanz and Vásquez (2011) of the Beck-II Depression Inventory (hereinafter BDI-II), and the State-Trait Anger Expression Inventory (hereinafter STAXI-2) in its Spanish adaptation from Spielberger, Miguel-Tobal, Casado-Morales, Cano-Vindel (2009).

The STAI is made up of 40 items which evaluate anxiety as a state and as a trait. Each item is answered with a four-level Likert-type scale: Nothing, Somewhat, Sufficient and Much, in which Nothing is scored as 0 and Much as 4.

The second instrument is made up of 21 items that is used to measure the severity of depression. Each item is answered on a four-point scale from zero to three except for items 16 and 18 which contain seven possible answers.

Finally, the STAXI-2 is made up of 49 items that are used to assess anger as a state and as a trait. Each item is answered with a four-level Likert-type scale: Not at all with a value of 1, Somewhat with a value of 2, Moderately with a value of 3 and Much with a value of 4.

To measure cognitive variables, students' university entrance records were consulted. For admission to the university, the College Board's Academic Aptitude Test (PAA) is applied as an admission test. This test assesses three fundamental areas of cognitive development: verbal reasoning and critical reading, logical mathematical reasoning and writing in Spanish. It is made up of three scales to evaluate each of the areas. The test contains 140 multiple-choice items with five options. The cognitive variables were: Verbal Reasoning, Mathematical Reasoning, Indirect Writing and Admission Score. The Admission Score is an average of the score obtained in the first three areas.

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In order to establish the reliability of the instruments in the sample under study, the Cronbach's Alpha test was performed on the pre-established factors for each questionnaire, which were maintained when performing an Exploratory Factor Analysis. The scores obtained in the questionnaire factors ranged between .67 and .90. (See table 1).

Table 1.
Cronbach's Alpha values of instruments

Instrument	Factors	Alpha
STAI	Anxiety Absent State	.90
	Anxiety Present State	.85
	Anxiety Absent Trait	.82
	Anxiety Present Trait	.85
BDI-II	Somatic-Motivational	.73
	Cognitive-Affective	.85
STAXI-2	External Expression	.67
	Internal expression	.70
	External control	.85
	Internal control	.78
	Physical expression	.78
	Verbal expression	.74
	Reaction	.78
	Temperament	.75
	Feelings	.76

Source: Self made

2.3 Population and sample.

The population under study were 2019 new undergraduate students from a Dominican university (N = 1690). A random sample of 719 students was selected with a confidence level of 95% and with a margin of error of ± 2.77. Regarding gender, 409 (56.88%) were women and 310 (43.12%) were men, with a mean age of 18.04 years (D. T. = 1284).
The Shapiro-Wilk test confirmed that the distribution was significantly different from the normal distribution, SW = .547, p = .000. The Inter quartile range was 1, so 50% of the distribution was concentrated in the ages of 17 and 18 years. The minimum age was 16 and the maximum was 36, but from 19 years of age the cases were considered atypical and, from 22 years of age as highly atypical.

2.4 Procedure.

For the application of the instruments related to affective variables, sections / courses were randomly selected. Participation was voluntary and the three instruments were applied the same day in the classroom. To obtain data of the Academic GPA and the results of the admission test, the academic record of the students who participated in the study was consulted with authorization from the students under study.

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3. Results.

3.1 Regression analysis for the total sample.

The Step-by-Step method (Stepwise) of the regression procedure only included the variables Admission Score, Indirect Writing, Anger: Internal Control and Anger-Trait: Reaction. For the total sample of 719 participants, the correlations of these variables with the Academic GPA are shown in table 2. This table shows that the only high positive and significant correlation was that of the Admission Score and Indirect Writing; all others were low and not significant.

Table 2.
Correlations of predictors with the Academic GPA for the total sample

Predictors		Admission Score	Indirect Writing	Anger: Internal Control
Indirect	Correlation	.835		
Writing	Sig. (2-queues)	.000		
Anger: Internal	Correlation	.031	.073	
Control	Sig. (2-queues)	.407	.052	
Anger-Trait:	Correlation	-.064	-.009	-.041
Reaction	Sig. (2-queues)	.089	.803	.277

Source: Self made

The regression model with four predictor variables could explain 24% of the variance for the Academic GPA (R2 = .242), with a significant F, F (4,710) = 56.676, p = .000, a large effect size (f^2 = .32) and an ideal test potency (1 - β = 1). Table 3 shows the standardized Beta coefficients, t tests and the significance of each of the predictors. In it, it can be seen that the best predictor of the Academic GPA was the Admission Score with a positive Beta coefficient, twice that obtained by Indirect Writing. In other words, its effect was double that of Writing. It can be observed that, compared with the cognitive variables, the affective variables only had a slight, although significant effect on the Academic GPA.

In other words, the Admission Score had four times more influence than the Anger: Internal Control factor and five times more than Anger-Trait: Reaction. However, in all cases the coefficients were positive, which means that the higher the score in each of the predictors, the higher the score in the Academic GPA.

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Table 3.
Summary of the regression analysis with the predictors of the Academic GPA for the total sample

Predictors	Standardized Coefficients	*t*	Sig.
Admission Score	.344	5.769	.000
Indirect Writing	.153	2.557	.011
Anger: Internal control	.086	2.624	.009
Anger-Trait: Reaction	.068	2.076	.038

Source: Self made

3.2 Regression analysis for the sample of men.

For the sample of 310 men, the regression model only admitted three variables as predictors of the Academic GPA: Admission Score, Anger: Internal Control and Depression: Cognitive-Affective. The correlations of these variables with the Academic GPA are showed in Table 4.

Table 4.
Correlations of predictors with the Academic GPA for the sample of men

Predictors		Academic GPA	Admission Score	Anger: Internal Control
Admission Score	Correlation	.440		
	Sig. (2- queues)	.000		
Anger: Internal Control	Correlation	.106	-.003	
	Sig. (2- queues)	.063	.953	
Depression: Cognitive-Affective	Correlation	-.148	-.111	.012
	Sig. (2- queues)	.009	.051	.830

Source: Self made

As shown in table 4, correlation of the Academic GPA with the Admission Score was positive, moderate and significant. Correlation with Depression: Cognitive-Affective was negative and, although low, significant. Correlation with Anger: Internal Control was not significant. This regression model with three predictor variables explained 22% of the variance of the Academic GPA (R2 = .215), with a significant F, F (3, 306) = 27.997, p = .000, a medium-high effect size (f^2 = .27) and a perfect test potency (1 - β = 1). Table 5 shows the standardized Beta coefficients, the t tests and the significance of each of the predictors for the sample of men.

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Table 5.
Summary of the regression analysis with the predictors of the Academic GPA for the sample of men

Predictors	Standardized Coefficients	*t*	Sig.
Admission Score	.429	8.423	.000
Anger: Internal Control	.108	2.137	.033
Depression: Cognitive-Affective	-.102	-1.999	.046

Source: Self made

This table shows that the most influential predictor on the Academic GPA was again the Admission Score, that is, as the scores on the Admission Score increased, those on the Academic GPA increased. That same relationship appeared with Anger: Internal Control predictor, but with only a quarter of the influence of the Admission Score. On the other hand, the influence of Depression: Cognitive-Affective factor on the Academic GPA was negative, that is, as the scores for this factor increased, the Academic GPA decreased.

3.3 Regression analysis for the sample of women.

In the sample of 409 women, the regression model only admitted one variable as a predictor of the Academic GPA, the Admission Score. The correlation of this variable with the Academic GPA was positive, moderate and significant, r (405) = .517, p = .000. This regression model with a single predictor variable explained 27% of the variance of the Academic GPA (R^2 = .267), with a significant F, F (1, 403) = 146.672, p = .000, a large effect size (f^2 = .36) and a perfect test potency (1 - β = 1). The Admission Score, for the sample of women, was the only statistically influential predictor on the Academic GPA with a standardized coefficient of more than half a deviation, highly significant (β = .517, t = 4.159, p = .000). In other words, as scores on the Admission Score increased, the Academic GPA increased. Table 6 shows the comparison of the standardized Beta coefficients of the total sample, men and women.

Table 6.
Comparison of the standardized Beta coefficients between the total, men and women

Predictors	Total	Men	Women
Admission Score	.344	.429	.517
Indirect Writing	.153		
Anger: Internal Control	.086	.108	
Anger-Trait: Reaction	.068		
Depression: Cognitive-Affective		-.102	

Source: Self made

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4. Discussion.

As previously mentioned, the main objective of this research was to determine the predictive capacity of cognitive and affective variables in the academic performance of university students. In this sense, it has been proven that cognitive and affective variables are predictors of academic performance, however, when comparing their impact, cognitive variables had an effect up to five times greater than affective ones. The effect of the affective variables, although significant, was slight. The role of skills in determining performance remains important. For all participants, regardless of gender, the admission test results were the best predictor of their performance. These results match those found by Rojas-Torres (2013), Rodrigo et al., (2012), Montero et al., (2007) and Garbanzo (2007).

It is important to highlight that of the components that make up the Admission Score, Indirect Writing was the only element that in isolation had an effect to predict performance for the total sample, but not Mathematical Reasoning and Verbal Reasoning. This result is understandable since the didactic and evaluative activities that are usually used at the university level mainly demand mastery of writing competence. Regardless of the discipline of study, as part of their academic work, students are required to have the ability to communicate ideas clearly and to write texts without making grammatical and rule errors in the structure. That is, university professors evaluate and expect students to master the morphosyntactic and lexical components in the writing of their academic papers and, in addition, to consider the semantic elements that contribute to ideological coherence on what they expose in their writings.

It must be recognized that writing and thought are closely intertwined, they are interdependent. There is evidence that difficulties in organization and coherence in the preparation of a text usually occur due to an incomplete understanding of the subject and the difficulty in constructing meanings rather than due to the same inability to write (Domínguez & Rivero, 2018). This explanation allows us to understand the predictive value of writing on academic performance. We can speculate that mathematical tests would reflect greater predictive utility if we considered the study area as a moderating variable.

Regarding the affective variables that have the ability to predict performance, only anger and depression contribute to the explanation of academic success or failure. In case of anger, specifically anger control factors and anger reaction trait. For all participants, it was found that the higher the score in each of these factors the higher the academic performance. That is, students who more often try to control their feelings of anger through calm and moderation of angry situations do better academically. Similarly, those who tend to experience angry feelings in situations that involve frustration or negative evaluations do better on their grades. These results show, as indicated by Ellis (2004) and Rowe and Fitness (2018), that there are circumstances in which negative affections can potentially be adaptive and improve performance.

In case of depression, the cognitive-affective dimension was shown to predict academic performance only in case of men. The higher the score in this factor the worse the academic performance. This means that male students who have feelings of worthlessness, guilt, self-dissatisfaction, self-criticism, sadness, and pessimism are more likely to perform worse. This result draws attention since generally, depression in men has somatization characteristics and

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women are the ones who frequently show symptoms in the cognitive-affective dimension (Castellanos et al., 2016).

The predictive value of the cognitive-affective dimension of depression in men can be understood from the explanation of the rational emotional-behavioral theory of Ellis (2004) according to which the cognitive interpretations of situations that a person experiences, dysfunctional or no, cause a certain emotional state that interferes with the achievement of goals. Hence, thoughts and feelings of worthlessness, inability, and self-dissatisfaction determine performance execution.

However, this same theory is insufficient to understand what happens with the group of women. Despite there is much evidence that indicates that women tend to show symptoms of depression more frequently than men, and also higher rates of anxiety disorders even within university population (Castellanos et al., 2016; Vázquez, 2016 , Obregón-Morales et al., 2020) and which are the ones that experience negative emotions with the greatest frequency and intensity (Fernández-Castillo et al., 2016), results of this study show that affective variables do not predict their academic performance. Suárez and Wilches (2015) indicate that women have more clarity and understanding about the emotions they experience, and men are characterized by paying more emotional attention. This difference could explain the results found in this study. However, gender differences in emotional self-regulation should be explored in other investigations.

5. Conclusion.

The results of this study provide evidence that academic performance can be explained by the influence of cognitive and affective variables; however, cognitive variables had a greater effect than affective ones. The affective variables that had predictive value were anger, specifically internal control and anger reaction, and the cognitive-affective dimension of depression. The results indicate that the predictive capacity of affective variables is different between men and women.

It must be borne in mind as stated in the factor accumulation theory that studying factors affecting performance in isolation can distort the understanding of their effects. It may be that some of the factors considered in this study alone is not significant; however, when appearing together with others, its effect increases. It is necessary to continue research on negative affectivity in the academic context taking into account contextual factors and not only personal ones. One of the limitations of this study is that environmental factors were not considered and that the sample only considered new students in the university system; the results could be different depending on the moment the student is in his academic career.

Similarly, it is necessary to broaden the investigation of anger in the academic context since it has been shown to have a predictive effect on performance. There is very little research on the subject to help us understand its impact.

It may be interesting to contrast whether the effects found remain invariant when considering other elements associated with the educational context such as academic load, teacher characteristics, and satisfaction with the career, among others. This would help to know to what extent other personal and contextual variables affect the cognitive affective functioning of students.

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