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Growth mindset, Grit, and Academic Self-efficacy as determinants of Academic Performance in Peruvian university students

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Abstract

Currently, the study of non-cognitive variables and their effect on the academic performance of students has gained relevance. In view of that, the purpose of the present study was to analyze through structural equation modeling to what extent growth mindset, self-efficacy, and grit have direct effects on student performance. For this, an explanatory design of latent variables was followed, in which 305 university students participated, including men (41.8%) and women (58.2%), who reported an average age of 22.8 (SD = 3.5), all included due to convenience. To measure the independent variables, the ITIS (growth mindset), Grit-S (tenacity) and EPAESA (academic self-efficacy) were applied, while for the measurement of the dependent variable, the grades of the students of the two last semesters were used. Among the main findings, it is reported that growth mindset, grit, and self-efficacy have direct and significant effects on the academic performance of students. In conclusion, this set of non-cognitive variables successfully explains the academic performance of the study participants.

Keywords

Higher education, university students, mindset, grit, academic performance

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Mentalidad de crecimiento, Tenacidad y Autoeficacia Académica como determinantes del rendimiento académico en universitarios peruanos

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Resumen

En la actualidad el estudio de las variables no cognitivas y su efecto sobre la performance académica de los estudiantes ha cobrado fuerza. En tal sentido, el propósito del presente estudio fue analizar mediante el modelamiento de ecuaciones estructurales en qué medida la mentalidad de crecimiento, la autoeficacia y el Grit tienen efectos directos sobre el rendimiento de los alumnos. Para ello, se siguió un diseño explicativo de variables latentes en el que participaron 305 estudiantes universitarios entre varones (41.8 %) y mujeres (58.2 %), quienes reportaron una edad promedio igual a 22.8 (DE = 3.5), todos elegidos por conveniencia. Para medir las variables independientes se aplicaron la ITIS (mentalidad de crecimiento), Grit-S (tenacidad) y EPAESA (autoeficacia académica), en tanto, para la medición de la variable dependiente se hizo uso de las notas de los alumnos de los dos últimos semestres. Entre los principales hallazgos se informa que la mentalidad de crecimiento, *grit* y autoeficacia tienen efectos directos y significativos sobre la performance académica de los estudiantes. En conclusión, este conjunto de variables no cognitivas logra explicar con éxito la performance académica de los participantes en el estudio.

Palabras clave

Educación superior, universitarios, mentalidad, tenacidad, performance académica

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Currently, the effect of non-cognitive attributes on students' academic performance is being discussed (McIlroy et al., 2017). In this regard, empirical evidence apparently supports the thesis that certain psychological attributes have direct effects on well-being, learning process and on academic performance (Pepi et al., 2006; Tovar-García, 2017; Pavithra et al., 2024). Moreover, unlike the cognitive components, these non-cognitive aspects are susceptible to modification through specific interventions (Burnette et al., 2022; Dweck & Yeager, 2019). since they tend to develop with greater emphasis during adolescence (Zhang et al., 2024). Among the range of non-cognitive variables that have been shown to be related to learning and academic goal attainment in higher education are academic self-efficacy (Honicke & Broadbent, 2016), growth mindset (Dweck, 1999), and grit (Duckworth et al., 2007).

From the field of social psychology, the Social Cognitive Theory (Bandura, 1977) remains today one of the most prominent models to explain the processes that drive and regulate behavior. The approach of this model is that behavior is motivated and regulated by a combination of external and internal factors: (a) the influence of the social system and (b) the capacity for self-influence (internal). As part of this last aspect, the concept of self-efficacy becomes relevant, understood as a person's judgment to evaluate their abilities to plan and execute the behaviors necessary to achieve the expected results in a specific field (Bandura, 2001), such as the academic one. In that context, academic self-efficacy refers to the students' judgment about their ability to successfully achieve goals at the educational level (Honicke & Broadbent, 2016). Such findings have been corroborated in a more recent systematic review, where a positive and moderate relationship between both constructs was also evidenced (r^{+} = .33; CI 95% [.28, .37]; $p < .0001$). It is worth mentioning that, according to the latter study, no significant impact was found in the magnitude of the relationship between self-efficacy and academic performance, based on how the latter variable was measured: self-reported academic performance *vs.* official grade reports (Honicke & Briadbent, 2016).

In this context, grit refers to the effort and endurance that is generated in people to persevere and achieve a goal in any area of life. At the same time, it refers to the consistency of interest when it is achieved (Alhadabi et al., 2023; Duckworth et al., 2007). Grit is a personal characteristic that would explain why some students can improve their performance even in adverse situations (Barriopedro et al., 2018; Han, 2023). Furthermore, Duckworth and Yeager (2015) argue that this attribute turns out to be a better predictor of academic success than cognitive ability, which is evidenced by meta-analytic findings in which it is reported to correlate moderately with performance in academic (Strayhorn, 2014; Daura et al. 2020; Han, 2023) and work environments (Sackett et al., 2012), moderating the relationship between occupational stress and depression in workers (Lee et al., 2023).

Several studies have analyzed the relationship between implicit theories of intelligence, academic self-efficacy, and grit and academic performance. Thus, Sulca and Quiroz (2021) identified that there is a positive relationship of a moderate magnitude between self-efficacy and academic performance. Likewise, McIlroy et al. (2024) studied the non-cognitive factors involved in the performance of high school students and found that academic self-efficacy is related to school performance. Meanwhile, Palisoc et al. (2017) found that grit is significantly related to goal pursuit and achievement. The latter finding coincides with what was reported by Bazelais et al. (2018), who identified that grit has a direct effect on academic success.

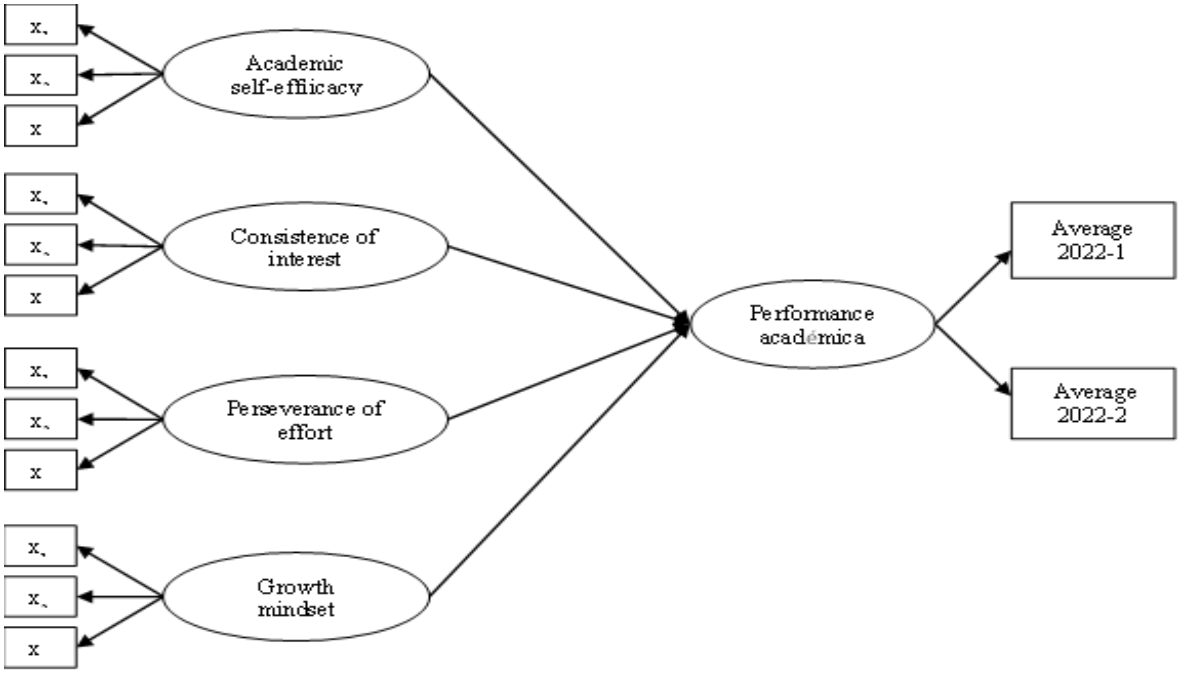
Another study conducted on Asian students found that grit predicts academic achievement (Tang et al., 2021; Tang et al., 2022).

Therefore, an explanatory model based on a set of non-cognitive variables that have sufficient empirical evidence to justify their effect on the academic performance of university students has been proposed for this research (Honicke & Briadbent, 2016; Frontini et al., 2022; Palisoc et al., 2017; Sackett et al., 2012). Buenconsejo and Datu (2020) analyzed the relationship between growth mindset and academic self-efficacy in a sample of Indian university students and found that this relationship is positive, significant, and, in turn, oriented towards career exploration. On the other hand, Kırmızı et al. (2023) developed a structural model where it is proposed that a growth mindset influences both perseverance in effort and consistency of interest. This model considers the beliefs adopted by students to achieve their goals, since not only the self-perception of their abilities is important to do so, but also persistence (Bandura, 2001). This coincides with Duckworth et al. (2007), who emphasize that consistency of interest and perseverance in effort determine the achievement of academic goals. In line with this, the growth mindset is linked to the perception of one's own capabilities, the development of which is based on effort (Hong et al., 1999; Dweck, 2006). In addition, Faust and Rosendale (2023) found that grit and self-efficacy have a direct impact on performance, especially in at-risk students. Recently, Denovan et al. (2023) identified that self-efficacy and grit are part of mental strengths, due to the associations found between the variables. This is reinforced by the existence of various studies where it is shown how these variables play mediating or moderating roles in the relationship of academic variables such as motivation, academic stress in college (Cinar-Tanriverdi & Karabacak-Celik, 2023), and life satisfaction (Ekinci & Koc, 2023).

Figure 1 shows the model that we intend to corroborate in this research. It is assumed that all latent variables are related, and the specific goal is to verify that academic self-efficacy, consistency of interest, perseverance of effort, and growth mindset have direct effects on academic performance in the study sample. Likewise, we seek to analyze variations in the model according to the sex of the participants, taking into account evidence that points to a higher performance by women at the beginning of their university studies (Dayioğlu & Türüt-Aşik, 2007) and to a greater presence of motivational aspects and higher self-efficacy as well, which predicts higher performance in this group (Grimaldo & Manzanares-Medina, 2023; Pirmohamed et al., 2017).

The findings of the present study will help to design educational policies focused on the proposed attributes to favor the development of these skills and improve the academic performance of university students. These policies could be applied more effectively during the first years of study (Caviglia-Harris & Maier, 2020), since, as mentioned by Kautz et al. (2014), non-cognitive attributes have proven to be not only important to improve academic performance but also various aspects of life, which could contribute to shape successful and responsible members of society (Nwosu et al., 2022).

Figure 1
Hypothetical Model of Academic Performance



Method

Design

This research is framed in a non-experimental design of explanatory type with latent variables (Ato & Vallejo, 2015). In this type of study, a measurement and a structural model are analyzed, which reflect the possible existing relationships based on the review of underlying theoretical models.

Participants

To estimate the sample size, the considerations proposed by Kline (2015) were followed, who indicates that a sample of more than 200 participants is advisable for this type of study. In this sense, to reach this suggested sample size, a non-probabilistic convenience sampling was used. This allowed gathering a total of 305 university students among males (41.8%) and females (58.2%) whose ages ranged between 17 and 30—with an average age of 19.7 for females and 19.9 for males—and who were in their second year of studies at a private university in Metropolitan Lima, mostly in the program of Health Sciences (35.5%). It was also required for participation that they had been studying without interruption for two consecutive semesters (2022-1 and 2022-2). Accessibility and homogeneous sociocultural characteristics were also considered.

Instruments

Implicit Theories of Intelligence Scale (ITIS, Dweck, 1999)

To measure the implicit theories of intelligence, the ITIS was applied. It is a measure composed of eight items, four of which measure the entity mindset (EM) and the remaining ones, the incremental mindset (IM), all with a Likert-type format where 1 is equivalent to *strongly disagree* and 6 to *strongly agree.* For the present study, we used the version adapted by Correa-Rojas et al. (2024) where the two-dimensional structure of the measure was corroborated (CFI = .996; TLI = .994; RMSEA = .036; WRMR = 0.523), establishing the factorial invariance of the measure by sex. Specifically, we used the first dimension corresponding to the incremental implicit theory, also defined as growth mindset, which obtained a categorical omega equal to .741[.703-.770].

Grit-S Scale (Grit-S; Duckworth and Quinn, 2009)

Adapted to Spanish by Tortul et al. (2020), it is composed of 12 items and has two subscales, CI and PE, with a Likert-type response scaling (1 = *not at all like me*, 5 = *very much like me*). The structural validity corroborated the two-dimensionality of both scales. The reliability of the Grit-O yields an alpha equal to .77 for CI and .73 for PE. For its part, the Grit-S obtained an alpha equal to .73 for the total, .76 for CI, and .73 for PE. For the present study, we examined the internal structure of the Grit-S scale in the study sample using confirmatory factor analysis with the Diagonal Weighted Least Squares (DWLS) method, confirming the scale's two-dimensional structure. The first factor (CI) showed factorial loads ranging from .729 to .845, while for the second factor (PE), loads ranged from .300 to .885 (χ^2/df=2.179; CFI=.993; TLI=.990; RMSEA=.062[.036-.088]). Regarding reliability, omega coefficients indicate adequate internal consistency, with values of .785 [.745-.824] and .700 [.650-.720], respectively.

Scale of Perceived Self-Efficacy in Academic Situations (EAPESA; Palenzuela, 1983)

To measure academic self-efficacy, the adaptation of Navarro-Loli and Domínguez (2019) was used. It is a unidimensional measure of ten items with responses on a Likert scale, whose options range from 1 (*Never*) to 5 (*Always*). The unidimensional structure was corroborated by confirmatory factor analysis, obtaining satisfactory fit indices (χ^2 = 49.426; g1 = 20; CFI = .985; RMSEA = .071). The internal consistency of the measure scores reached an alpha equal to .866[.835-.891] and an omega equal to .901.

Academic Performance

To measure the academic performance of the participants, grade point average was calculated from the grades for semesters 2022-1 and 2022-2; then, the latent variable defined as academic performance corresponding to said semesters was calculated from these scores.

Procedures

Measurements were conducted using Google forms distributed between the months of December and January 2022. The recommendations of the American Educational Research Association (AERA), the American Psychological Association (APA), and the National Council on Measurement in Education (NCME) (AERA, APA, & NCME, 2018) regarding anonymity and data protection were followed. Through informed consent, participants were informed of the purpose of the study, the voluntary nature of participation, and the confidentiality of information.

Data Analysis

The Rstudio software was used for data analysis, specifically the Lavaan package (Rosseel, 2012). In the first stage, the database was explored to identify the presence of missing data and outliers that could affect the results. Then, the descriptive analysis of the variables was performed, including minimum score (Min), maximum score (Max), mean (M), standard deviation (SD), skewness coefficient (g1), kurtosis (g2), and coefficient of variation (CV), where values below .10 correspond to very homogeneous data and values above .25 correspond to very heterogeneous data. Likewise, the internal consistency of the instruments used is verified (Brown, 2023).

Likewise, correlation analysis was performed to identify the relevance of the variables to be included in the structural model. Pearson's correlation coefficients (*r*) were interpreted as follows: <.20 weak relationship, <.50 moderate relationship, >.50 strong relationship, >.70 very strong relationship (Cohen, 1992).

To establish the measurement and structural model, the suggestions of Medrano and Muñoz-Navarro (2017) were followed: model specification based on literature review, model identification, model estimation, model evaluation, and model re-specification. Therefore, as a previous step, we proceeded to classify the variables considering the empirical evidence and the literature review with the following results: academic performance (y), growth mindset (x_1), consistency of interest ($x_{2.1}$), perseverance of effort ($x_{2.1}$), and academic self-efficacy (x_3). For this purpose, the classification of Kerlinger and Lee (2002) was considered, who point out that independent variables are those that have effects on the dependent variable.

To analyze the proposed model, structural equation modeling (SEM) was applied, and the Diagonal Weighted Least Square (DWLS) estimator was used because it is more effective with small samples (Li, 2016). To evaluate the model fit, the indices χ^2 /df < 5; CFI and TLI > .95; RMSEA < .05; SRMR < .05 and WRMR were reviewed, where values close to zero are considered adequate (Kline, 2015).

Results

Descriptive Analysis

Table 1 shows the descriptive statistics of the scores for academic performance (dependent variable), growth mindset (independent variable), consistency of interest (independent variable), perseverance of effort (independent variable), and academic self-efficacy (independent variable). It is observed that the averages in most of these variables present a tendency towards maximum scores, suggesting a strong presence of these attributes. However, in the case of consistency of interest, the average of their scores tends towards the minimum scores, which denotes a low presence of this attribute.

Table 1

Descriptive analysis of variables

	Min	*Max*	*M*	*DE*	ω	1	2	3	4	5
1. Academic performance	13.04	19.07	16.55	1.27	.82	-				
2. Growth mindset	14.00	24.00	18.82	2.81	.73	.25**	-			
3. Consistency of interest	4.00	19.00	10.81	2.94	.78	-.14**	-.06	-		
4. Perseverance of effort	10.00	20.00	15.81	2.19	.70	.31**	.26**	-.40**	-	
5. Academic self-efficacy	18.00	40.00	29.06	6.11	.88	.30**	.32**	-.41**	.50**	-

***p* < .01 (one-tailed)

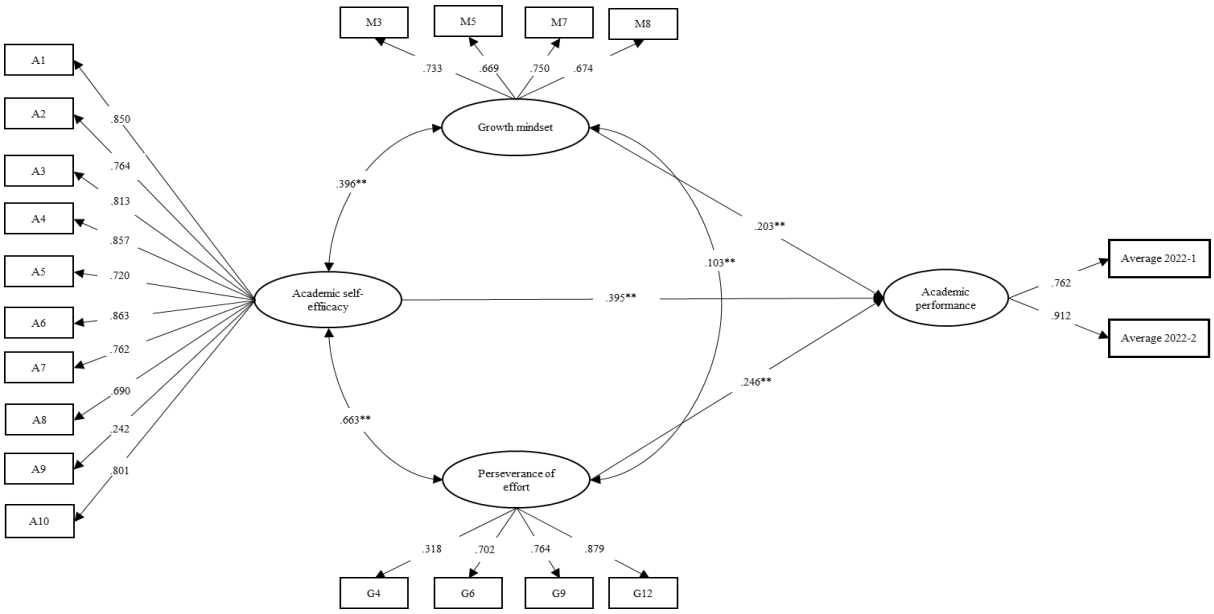
Correlations between scale scores were also analyzed to identify those that are significant with academic performance. Growth mindset, perseverance of effort, and academic self-efficacy were found to have statistically significant positive correlations of moderate magnitude with academic performance, while the consistency of interest scores were found to be non-significant with student performance and with the other variables. All measurements obtained adequate reliability coefficients (see Table 1).

Structural Equation Modeling

Based on the results shown in Table 1, it was decided to exclude consistency of interest for the overall sample from the model. Figure 2 shows the structural equation model that accounts for the academic performance of the study sample. The model is consistent and interpretable in relation to the fit indices obtained (χ^2/g1= 2.630; CFI = .985, TLI = .982; RMSEA = 0.073[0.065-0.082], SRMR = 0.070, WRMR=0.804).

Figure 2

Structural Model for Academic Performance



The analysis of the measurement model for academic self-efficacy shows factor loadings greater than .600, except for item 9. In the case of the measurement model for growth mindset, its factor loadings range from .660 to .750. In the case of the measurement model for perseverance in effort, the saturations range from .318 to .879. For academic performance, the saturations for grade point averages 2022-1 and 2022-2 were .762 and .912, respectively. Then, the structural model accounts for statistically significant standardized betas for all variables—growth mindset (.203, $p < .001$), perseverance of effort (.246, $p < .001$), and academic self-efficacy (.103, $p < .05$).

Gender-Differentiated SEM Models

The models differentiated by sex are shown below. Figure 3 shows the model for women (*n = 182*), which is like the general model where self-efficacy, growth mindset, and grit reach positive and statistically significant betas. To explain academic performance, these relationships are represented in a parsimonious and interpretable model ($\chi 2/g1 = 2.203$; CFI = .983, TLI = .980; RMSEA = 0.082[0.070-0.093], SRMR = 0.078, WRMR = 0.827).

Figure 3

Structural Model for Academic Performance in Female Students

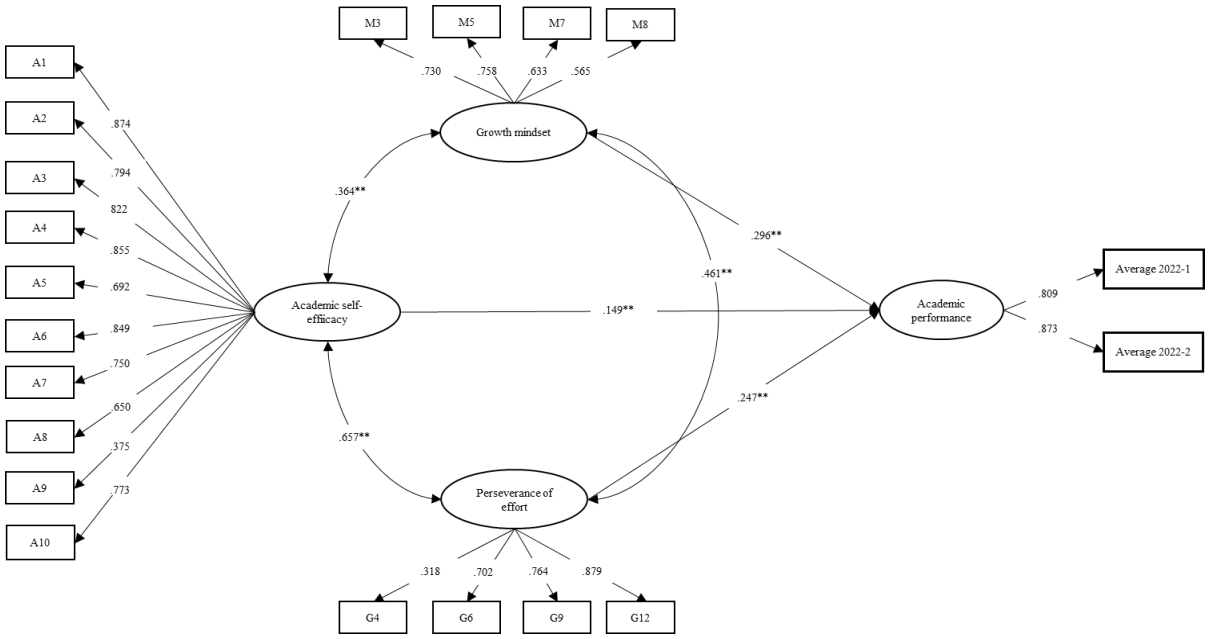
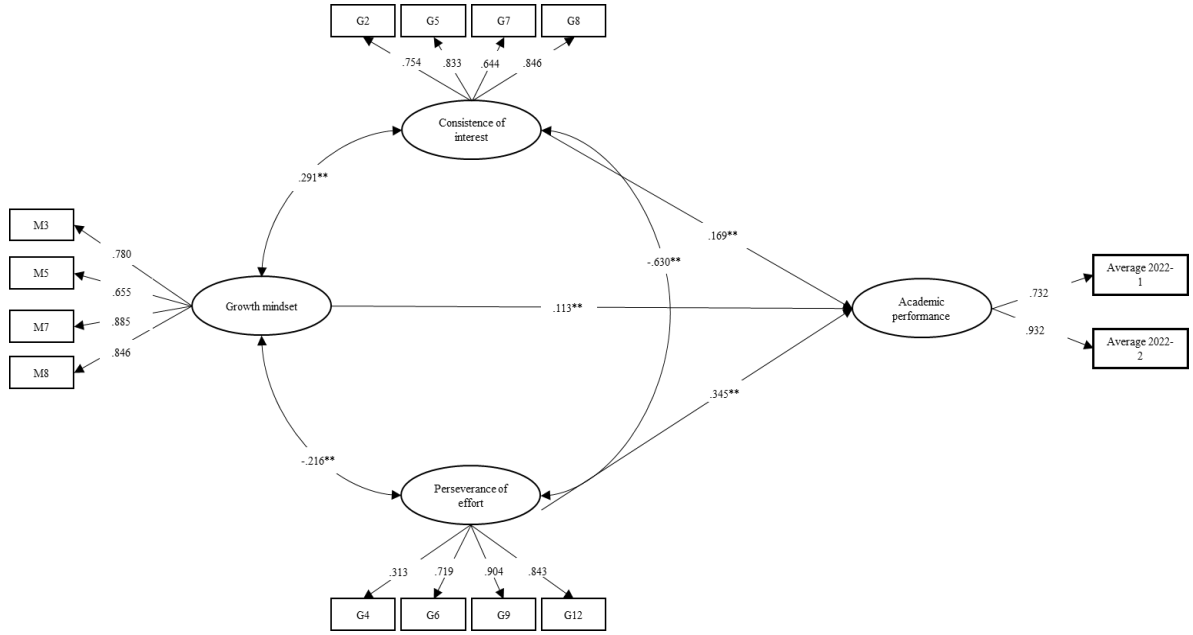


Figure 4 shows the model for males (n = 123) in which variations are observed. In this case, academic self-efficacy is excluded because it does not present statistically significant effects ($p < .05$) on academic performance. Thus, the model is composed of consistency of interest, perseverance of effort, and growth mindset, all with positive and statistically significant effects. As for the relevance of the model, it is consistent and interpretable ($\chi 2/g1 = 2.203$; CFI = .983, TLI = .980; RMSEA = 0.082[0.070-0.093], SRMR = 0.078, WRMR = 0.827).

Figure 4

Structural Model for Academic Performance in Male Students



Discussion

The purpose of the study was to identify a model to explain the non-cognitive determinants of academic performance in a sample of university students from Lima. The results showed two student variables as significant determinants of academic performance: on the one hand, growth mindset and, on the other, perseverance of effort. In the case of academic self-efficacy, this variable is related to the constructs, but its explanatory capacity on academic performance is barely relevant.

The above results are related to what Postigo et al. (2019) posit when they point out that the growth mindset is important when people must face challenges—in this case academic challenges, possibly leading to perseverance of effort, as found in the present study. This could impact on security, confidence, and the possibility of obtaining academic success, which would generate incentives that stimulate their effort (Park et al., 2018). In this way, these underlying beliefs about learning make growth possible by generating unlimited potential to incorporate new knowledge (Dweck, 2006).

The findings relate to the proposal of Blackwell et al. (2007) when they posit that growth mindset in students influences better academic performance when aligned to favorable learning goals (Robins & Pals, 2002), which implies improvements in motivation and concentration (Ommundsen, 2005), in the level of optimism to learn (Romero et al. 2014) and greater chances of achieving success (Eskreis-Winkler et al., 2014).

Similarly, it has been found that perseverance of effort is the component of Grit that has the greatest predictive power (Datu et al., 2016) and is related to academic performance (Bazelais et al., 2018; Peterson & Park, 2009; Peterson & Seligman, 2004; Tang et al., 2021; Tang et al., 2022). As can be seen, both variables are related and nurture each other; thus, by developing growth mindset, perseverance of effort is also improved (Dweck, 2012); this makes students stronger, improving their motivation and academic achievement (Blackwell et al., 2007), regardless of situations involving complications or failures (Brock & Hundley, 2018). Likewise, the findings of the study are consistent with those reported by Kırmızı et al. (2023). These results imply that both perseverance in effort and consistency of interest are influenced

by a growth mindset, as it allows students to channel their energy and focus on personal development. This would help them face academic challenges using these personal resources.

However, regarding academic self-efficacy, it has been found that it is related to both growth mindset and perseverance of effort, a component of grit. In this regard, self-efficacy and growth mindset are constructs that are associated with the individual management that takes place in the face of the challenges generated in the educational context (Parker, et al., 2016). Self-efficacy's impact on growth mindset would be linked to academic commitment and performance (Smith, 2015), as has been found in this study.

Regarding the relationship found between self-efficacy and perseverance of effort, both constructs have been found to be predictors of final grades among students (Muenks et al., 2018), like what was reported in the general model of this study. This suggests that self-efficacy impacts perseverance of effort, which in turn impacts academic performance. This is similar to what was reported by Faust and Rosendale (2023). On the other hand, Wolters and Hussain (2015) regressed academic self-efficacy in university students on both facets of grit and found that only perseverance of effort was related to self-efficacy, but not consistency of interest, which is also consistent with what was reported in this research. The relationship found between perseverance in effort and academic self-efficacy is supported by what was presented by Denovan et al. (2023), who argue that these variables are capable of predicting academic performance because they are part of mental strengths. These strengths have different developments in each person, and it is these attributes that enable overcoming academic challenges (Han, 2023; Faust & Rosendale, 2023).

In relation to sex, it has been shown that in the case of boys, consistency of interest and perseverance of effort—in other words, grit—have a direct and significant impact on academic performance. These results are consistent with what Strayhorn (2014) found in a sample of African American male students by generating a predictive model for an increase in their grades. It is likely that both males and females perform their academic activities differently such that grit is more relevant to academic success in males compared to females (Whipple & Dimitrova-Grajzl, 2020). In the same vein, Stewart (2015) found a correlation between grit and achievement in first-year male university students, which was not found in the female sample.

Regarding the growth mindset, Dweck and Simmons (2014) point out that girls are more sensitive to criticism than boys, which is shaped by the praise and reinforcement they receive from parents and teachers. In view of this, the differences found would be related to the way academic challenges are faced.

In summary, it was found that when analyzing the model in the study sample, academic performance is directly and significantly explained by growth mindset and perseverance of effort, while academic self-efficacy has only a small effect on it. A similar situation occurred in the female sample, although, when developing the model in the male sample, it was found that academic performance is directly and significantly influenced only by consistency of interest, perseverance of effort, and growth mindset. Finally, the research results allow us to confirm that both academic self-efficacy, perseverance in effort, consistency of interest, and growth mindset have effects on academic performance, as they are mental strengths that develop individually from experiences. Growth mindset is particularly important as it enables the components of grit to be oriented towards personal development.

With respect to the limitations of the study, first, the application was carried out in a single institution, which may make generalization difficult. In this sense, it is recommended that data collection be extended to students from multiple institutions of higher education. Secondly, although it is true that two academic semesters were considered in the analyses for the dependent variable, it is necessary to continue analyzing this model throughout the different study terms to see variations in the influence of non-cognitive determinants. Also, since the measurements are derived from self-report questionnaires, they may be subject to bias due to social desirability, although an attempt was made to maintain the anonymous nature of the responses during the application process. Finally, for future research, it is recommended that the model be further explored based on more specific measures of performance such as grades for subjects or courses that evaluate specific outcomes and competencies.

Interest conflict

The authors declare that they have no conflicting interests.

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