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Self-Efficacy, Self-Regulation and Procrastination; Necessary Conditions for a Higher Academic Performance in University Students

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Abstract

In recent years, and due to Spain's entry into the European Higher Education Area (EHEA), university education has undergone significant changes with the aim of increasing student participation in the teaching-learning processes. To this end, factors modulating of a greater or lesser academic performance have been analyzed. 388 undergraduate students of the Early Childhood and Primary Education Degrees, belonging to the Faculty of Humanities and Education Sciences of the University of Jaén, (Andalusia) [Spain] participated in this study. Of these, 312 (80.4%) were women and 72 (18.8%) were men; average age was 19.73 years (SD=1.783). The Academic Situations Specific Perceived Self-Efficacy Scale (Escala de Autoeficacia Percibida Específica de Situaciones Académicas: EAPESA); the "performance" dimension of the Academic Self-Concept Scale (Escala de Autoconcepto Académico: EAA) and the Academic Procrastination Scale (Escala de Procrastinación Académica: EPA) were used. The objective of this research was to provide sufficient evidence on the relationship between self-efficacy and self-regulation, with the procrastination dimension as intercept variable, on academic performance. This research presents the combined use of Partial Least Squares Structural Equation Modelling (PLS-SEM) and Necessary Conditions Analysis (NCA) to explore the raised hypotheses. The model results showed high coefficients of determination for Self-efficacy [(Q2=0.094); (R^2 =0.148)]; Performance [(Q2=0.011); (R^2 =0.207)] and Postponement [(Q2 =0.571); (R^2=0.592)]. The results show the effectiveness of the combined use of PLS-SEM and NCA to identify some dimensions necessary for higher performance, according to the logic of need. The theoretical combination of both perspectives will allow us to address the multidimensionality of those factors that contribute to improved academic performance.

Keywords*:* Self-Efficacy, Self-Regulation, Procrastination, Academic Perfomance, Postponement.

Introduction

In recent years, university education in Spain has undergone a drastic change. These changes are mainly due to Spain's entry into the European Higher Education Area (EHEA). One of the main aims of the EHEA is to increase the

student participation in the teaching-learning process in order to achieve a higher academic performance. To do this, it is necessary, on the one hand, to know the factors that lead to obtaining appropriate results in the subjects and degrees and, on the other hand, to understand which are the factors that hinder this objective. For this reason, there is a great interest in knowing the characteristics, skills, aptitudes and competencies that lead students to achieve high academic performance, since it requires a series of regulatory processes such as self-regulation and metacognitive learning strategies, which are influenced by self-efficacy (Pajares y Shcunk, 2001). Thus, some of the variables studied in this regard are self-efficacy, self-regulation and procrastination.

Self-efficacy

Self-efficacy is understood as a psychological state in which the person evaluates his/her capacity and ability to perform a certain task, activity or behavior, among others, in a specific situation with an expected level of difficulty. (Bardales et al., 2006). Self-efficacy consists of three dimensions (Bandura y Adams, 1977; Maddux, 1995): the first dimension refers to the perception of difficulty of the task and the possibility of being able to do it correctly; the second dimension is the person's confidence to carry out the task and meet the objective.; the third dimension is the generalization of the objectives achieved and transfer of the information to other areas of life.

Self-efficacy is a way of predicting human behavior since the person's own perceptions about his/her capabilities show what the person does with his/her abilities, skills and knowledge (Pajares y Schunk, 2001). The perception of one's own efficacy influences the person, since these beliefs act on feelings, thoughts and behaviors (Bandura, 1995), therefore, self-efficacy will also influence learning, since it is a factor related to the performance of activities and decision-making. (Bandura, 1997; Pastorelli et al., 2001).

Academic self-efficacy is understood as the evaluation that the student makes of his/her abilities before academic activities. (Blanco et al., 2011). This construct explains the differences in academic performance among people with the same level of knowledge and ability. (Pajares, 2002). The importance of this construct in learning has been studied for a long time, as shown in the study by Brown et al. (1986) in which it was found that university students with high self-efficacy obtained better marks and were more persistent than students with low self-efficacy.

In addition, self-efficacy is a predictive construct of academic performance, since it affects a person's behavior in terms of the effort made, the decisions taken, the perseverance and the emotional reactions (Alegre, 2014; Conteras et al., 2005, Galleguillos & Olmedo, 2017, García-Fernández et al., 2010; Kohler, 2009 and Schmidt et al., 2008). Moreover, Poloni and Bonetto (2013) indicate that self-efficacy has a bidirectional relationship with academic performance and achievement. For this reason, it is important to know how self-efficacy acts on students' academic performance and learning since, in this way, depending on the person's level of self-efficacy we will be able predict his/her performance.

Self-regulation of learning

This construct has been widely investigated since the 1980s. by both researchers and educational professionals due to the influence that it has on learning since it predicts academic performance (Boekaerts et al., 2005; Cerezo et al., 2010; Hoyle, 2013; Lennon, 2010; Vohs & Baumeister, 2011; Zimmerman, 1989). Self-regulation of learning can be defined as a self-directed process in which students transform their mental abilities into academic skills, self-generating thoughts, feelings and behaviors that are oriented towards goal-achievement (Zimmerman, 2002). Self-regulation is a process that enables students to transform their skills into academic competencies; it requires effort, persistence and time to carry out the tasks. (Zimmerman & Moylan, 2009).

Students who self-regulate their learning, monitor their behavior in order to achieve the objectives set and also reflect on their own

progress. (Rosario et al., 2014). All the aforementioned, increases their personal satisfaction and the motivation to improve their learning strategies, which will improve their academic performance and, therefore, their expectations will improve for future learning situations (Núñez et al., 2011; Pérez et al., 2011).

Academic procrastination

Procrastination is understood as the tendency to leave academic activities and then postpone the execution of the task, which causes anxiety due to the non-fulfilment of the task (Busko, 1998). It should be understood that this variable is a problem in self-regulation processes, since it consists of voluntarily delaying previously planned activities being the person aware of the negative consequences of this delay in carrying out the activity (Steel & Ferrari, 2013). According to Alegre (2013), academic procrastination is composed of three components.: first, the cognitive component referred to excuses and rationalizations for delaying the task; secondly, the behavioral component, related to impulsivity, distraction and inconsistency between the objective to be achieved and what is finally done; and finally, the emotional component, linked to emotions after failing in the academic field.

There are two types of academic procrastination, sporadic and chronic. In the former, specific academic tasks are delayed, mainly for time management reasons, while the latter implies that procrastination is a generalized habit. (Schouwenburg, 2004).

As is clear, high procrastination will affect academic performance and even school absenteeism, but chronic procrastination will have even more negative effects. This construct is considered a cause of school failure and dropout. (Rodríguez y Clarina, 2017). In addition, it is associated with feelings of anxiety regarding the academic situation (Bui, 2007; Rothblum, et al., 1986) and anxiety in front of exams (Quant & Sanchez, 2012). On the other hand, procrastination has also been associated with low self-efficacy (Klassen & Kuzucu, 2009; Schouwenburg, 2004; Williams et al., 2008) and with failures in the academic self-regulation process (Klassen & Kuzucu, 2009; Schouwenburg, 2004; Williams et al., 2008). (Chan, 2011; Sampaio & Bariani, 2011).

All of the above indicates that the three objectives construct of the present study are interrelated and are of great importance in the academic field, since all of them greatly affect the student's academic performance (Figure 1).

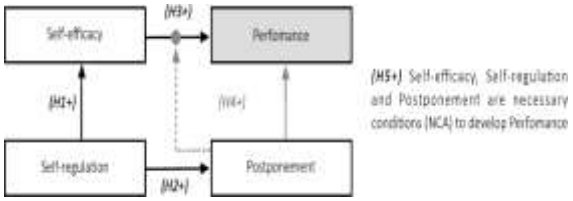

Figure 1. Conceptual model

Therefore, the hypotheses of the study are:

Hypothesis 1 (H1+): Perceived self-efficacy specific of academic situations is positively related to self-regulation of learning

Perceived self-efficacy, or students' perception of their ability to perform specific academic tasks, is related to the ability to control and regulate the learning process. Various studies have shown the relationship between perceived self-efficacy and self-regulation of learning in university students, corroborating that perceived academic self-efficacy and self-regulation of learning are related factors, although they had no influence on academic performance. (Flores-Araya et al., 2022). Other research evaluated the relationship among perceived self-efficacy, learning goals, and strategies for self-regulated learning; finding that self-efficacy and self-regulation of learning are predictors of 43% of the variance in the objectives set by students (Zimmerman & Schunk, 2011). Likewise, other studies corroborated how self-efficacy together with hope, fear and despair tend to favor self-regulation processes in a positive way. (Hernández-Barrios & Camargo-Uribe, 2017).

Hypothesis 2 (H2+): Self-regulation in learning and postponement are dimensions of the academic procrastination construct.

Different research has identified two dimensions of the academic procrastination

construct: self-regulation in learning and postponement of activities; showing that students who procrastinate have less self-regulatory learning skills than students who do not procrastinate (Westgate et al., 2017). García-Martínez & Silva-Payró (2019) assessed the relationship between academic procrastination and self-regulation of learning in university students, showing that academic procrastination was negatively related to self-regulation of learning. This suggests that students who procrastinate have less ability to control and regulate their own learning process.

Hypothesis 3 (H3+): Self-efficacy is positively related to academic achievement.

Some studies that have analysed the relationship between self-efficacy and academic performance in university students have found a positive relationship between perceived academic self-efficacy and academic performance This leads us to consider the former a determining psychological variable and strongly predictive of academic achievement (Pajares 2001), being a cognitive construct that mediates between competence and performance. (Pintrich & De Groot, 1990). A more recent study has analysed the relationship between perceived self-efficacy and academic performance, showing that self-efficacy was an effective predictor of academic performance. (Rosales-Ronquillo & Hernández-Jácquez, 2020).

Hypothesis 4 (H4+): Academic postponement will directly influence the relationship between self-efficacy and academic performance.

Students who postpone have fewer abilities to control and regulate their own learning process, less confidence in their ability to perform specific academic tasks, and less likelihood of academic success, even if they have high self-efficacy. About 90% of students suffer from it at some period of their lives (Gustavson & Miyake, 2017). The effects of postponement entail a series of consequences, mainly on the academic performance of university students, who perform academically according to previously established deadlines (de Palo et al., 2019).

Hypothesis 5 (H5+): Self-efficacy, self-regulation in learning and a low level of postponement are necessary conditions for higher academic performance.

Results from different research studies seem to show that self-efficacy for self-regulation of learning is related to a greater use of cognitive strategies and to the adoption of motivational beliefs (Ferla et al., 2010) and, therefore, to better academic performance (Ferla et al., 2010). (Özberk & Kurtça, 2021; Scheunemann et al., 2021). Likewise, it seems essential to consider variables such as homework procrastination as an intercept of the students' own learning control strategies. Thus, different research on academic performance considers the level of student self-efficacy as conditioned when we talk about procrastination of homework (Scheunemann et al., 2021). In general terms, the use of self-regulation strategies for both learning and academic performance are favored by greater self-efficacy beliefs for the use of self-regulation strategies; on the contrary, a high level of task procrastination systematically conditions the learning process and the degree of self-efficacy of students (Baumann & Harvey, 2021).

Method

Sample

The sample consisted of 388 university students from the Early Childhood and Primary Education Degrees, belonging to the Faculty of Humanities and Education Sciences of Jaén (Andalusia) [Spain]. A non-probabilistic sampling, by chance or accessibility, was used for the selection. The distribution of the participants by gender was as follows: 312 were women (80.4%), 72 were men (18.8%), and 72 were women (18.8%). The age range was between 17 and 28 years, with an average age of 19.73 years (SD=1.783). A power of 89.2% was obtained, above the recommended threshold (85%), with a significance level of 5%, to detect R2 values below 10% (Cohen, 1988). No problems related to sample size were identified.

Instrument

Academic Situations Specific Perceived Self-Efficacy Scale (EAPESA; Palenzuela, 1983).

The scale consists of 10 items. Its objective is to measure self-efficacy expectations in specific situations of the educational context in adolescent and university students. Originally, the 10 items are evaluated through a 10-point Likert-type response scale, although in this study the abbreviated 7-point version (1 = Strongly disagree; 7 = Strongly agree) proposed by García-Fernández et al. (2010) was used. The questionnaire has demonstrated adequate reliability: internal consistency index α=0.91.

Academic Self-Concept Scale (EAA; Messoulam y Molina, 2008).

In this research only the Academic Performance dimension and possible learning difficulties are evaluated. Validity evidence (Schmidt, Messoulam, & Molina, 2008) showed that the EAA explains 43% of the variance and the Academic Performance factor 23.6%. The internal consistency reliability for the Academic Performance factor presented acceptable levels: Cronbach's alpha coefficient, α=0.68.

Academic Procrastination Scale (EPA, Busko (1998), adapted into Spanish by (Dominguez-Lara et al., 2014).

This scale consists of 12 items to assess academic self-regulation (9 items) and academic procrastination (3 items). A 7-point Likert-type scale (1 = Strongly disagree; 7 = Strongly agree) was used. It can be applied individually or in groups, with an average time of 10 minutes. The study carried out obtained a reliability of α=0.80.

Procedure

National and international ethical guidelines were followed to develop the research and data collection. All data were handled in accordance with the regulations set forth in Regulation (EU) 2016/679 of the European Parliament and of the Council, of April 27, 2016, on the protection of natural persons with regard to the processing of personal data and on the free movement of such data; and Organic Law 3/2018, of December 5, on Personal Data Protection and guarantee of digital rights.

Students were assured that their responses would be kept anonymous and confidential, and that all information provided would be used exclusively for scientific purposes. In addition, the researchers explained to the students the purpose of the research and the guidelines for its correct development. The research instrument was administered individually through the Google Forms platform by the responsible teaching staff.

Finally, the data were collected and their quality was verified, ensuring at all times the ethical principles for research established in the Declaration of Helsinki (World Medical Association, 2013).

Data analysis

Several statistical analyses were performed in this study. First, the multiple-entry Hot-Deck method was applied to minimize any bias, ensuring to keep both joint and marginal distributions; then, means and standard deviations were calculated (Lorenzo-Seva y Van-Ginkel, 2016).

A previous analysis was carried out in order to evaluate the validity, reliability and internal consistency of each instrument. This was achieved through a Confirmatory Factor Analysis (CFA) to verify the psychometric properties of the questionnaire and to determine the factor loadings of each item.

On the other hand, to verify the normality of the data, a multivariate hypothesis test was performed, revealing that the distribution was not normal. All these analyses were performed using Jamovi v.1.2 and SmartPLS 4 software (Ringle et al., 2022).

Regarding the coefficients considered in the study, the $\chi 2$/df ratio, the Root Mean Squared Error of Approximation (RMSEA) and the Comparative Fit Index (CFI) were used. The model was considered adequate when the Tucker-Lewis Index (TLI) and CFI were $\geq$

0.95, and the RMSEA was close to 0.07 (Kline, 2016).

To assess convergent validity, the Average Variance Extracted (AVE) was calculated, which had to be greater than 0.50 (Hair et al., 2021). Regarding discriminant validity, the criteria of Fornell & Larcker (1981) were applied. These indicate that the square root of the AVE of each variable must be greater than the correlations it has with the other variables. In addition, the Heterotrait-Monotrait ratio (HTMT) was used, which had to be less than 0.90 (Henseler et al., 2015).

To evaluate the significance, size and direction of the coefficients of the structural model, the bootstrap approach was used with 5000 samples. (Hair et al., 2021). Results were considered statistically significant at a 95% confidence level ($p < 0.05$).

Partial least squares structural equation modeling (PLS-SEM) was chosen in this study due to its suitability to explain and predict endogenous constructs, without making assumptions about the distribution of the data (Hair et al., 2021).

Results

The Mardia-Test for Multivariate Normality, Skewness, and Kurtosis was used with the observed variables. The results revealed that the data did not fit a normal distribution.

In addition, analyses were performed to verify the assumptions of multicollinearity, homogeneity and homoscedasticity, in order to confirm that the resulting distribution met the criteria of interdependence among variables.

Based on the data collected with each of the instruments (Table 1), a Confirmatory Factor Analysis (CFA) was performed to evaluate both the validity and the internal structure of each item.

Table 1. Factor loadings

Factor	Indicator	α	ω	Estimate	SE	Z	p	Stand. Estimate	CR	MVE
Self-efficacy	item 1	0.885	0.910	0.540	0.0991	5.45	< .001	0.529	0.910	0.519
	item 2	0.867	0.894	0.773	0.0804	9.62	< .001	0.816		
	item 3	0.866	0.893	0.805	0.0844	9.54	< .001	0.812		
	item 4	0.861	0.889	0.931	0.0858	10.85	< .001	0.880		
	item 5	0.869	0.894	0.753	0.0784	9.60	< .001	0.815		
	item 6	0.891	0.914	0.543	0.1235	4.40	< .001	0.439		
	item 7	0.872	0.897	0.767	0.0849	9.04	< .001	0.783		
	item 8	0.865	0.894	0.964	0.0998	9.65	< .001	0.818		
	item 9	0.909	0.918	0.479	0.1604	2.99	0.003	0.306		
	item 10	0.869	0.898	0.859	0.0994	8.65	< .001	0.759		
Perfomance	item 1	0.828	0.829	0.925	0.124	7.49	< .001	0.708	0.854	0.496
	item 2	0.833	0.834	0.998	0.141	7.09	< .001	0.681		
	item 3	0.837	0.838	0.777	0.118	6.58	< .001	0.642		
	item 4	0.832	0.834	0.808	0.115	7.03	< .001	0.677		
	item 5	0.840	0.841	0.828	0.132	6.27	< .001	0.623		
	item 6	0.829	0.831	0.905	0.123	7.33	< .001	0.696		
	item 7	0.828	0.831	0.927	0.128	7.25	< .001	0.697		
Postponement	item 8	0.861	0.871	0.677	0.1024	6.61	< .001	0.653	0.695	0.498
	item 9	0.853	0.865	0.860	0.1188	7.24	< .001	0.711		
Self-regulation	item 2	0.850	0.862	1.028	0.1247	8.25	< .001	0.744	0.846	0.501
	item 3	0.888	0.890	0.527	0.1375	3.84	< .001	0.393		
	item 5	0.854	0.865	0.830	0.1041	7.97	< .001	0.731		

item 10	0.845	0.854	0.906	0.0940	9.64	< .001	0.830
item 11	0.847	0.858	0.924	0.1053	8.78	< .001	0.785
item 12	0.862	0.873	0.672	0.1026	6.55	< .001	0.626

Note: SE: Standardized error; Z: Z-value in the estimate; p: p-value of Z estimate; β: Standardized estimate; MVE: Average Variance Extracted; CR: Critical ratio.

Academic Situations Specific Perceived Self-Efficacy Scale (EAPESA). The factor loadings for the items of this scale presented an adequate fit (Hair et al., 2021): $\chi 2/df = 2.37$, with CFI = 0.916, SRMR = 0.055, RMSEA = 0.077. The reliability of this scale was: Cronbach's α = 0.887 and McDonald's ω = 0.909.

Academic Self-Concept Scale (EAA). The factor loadings for the items of this scale presented an adequate fit (Hair et al., 2021): $\chi 2/df = 1.97$, with CFI = 0.942, SRMR = 0.049, RMSEA = 0.069. The reliability of this scale was: Cronbach's α = 0.853 and McDonald's ω = 0.854.

Academic Procrastination Scale (EPA). The factor loadings for the items of this scale presented an adequate fit (Hair et al., 2021): $\chi 2/df = 2.442$, with CFI = 0.922, SRMR = 0.047, RMSEA = 0.079. The reliability of this scale was: Cronbach's α = 0.873 and McDonald's ω = 0.882.

PLS path model

To determine whether there is a relationship between each of the dimensions (Figure 2), the coefficient of determination (R2), the cross-validated redundancy (Q2) and the path between variables were analyzed (Chin, 1998; Hair et al., 2021). The R2 value measures the variance explained in each of the endogenous constructs. According to our model, the R2 index for Self-efficacy was 14.80%; Perfomance was 20.70%; and Postponement, 59.20%, which are considered acceptable values (Chin, 1998).

Predictive relevance was also assessed using the Stone-Geisser Q2 statistic (Hair et al., 2021; Stone, 1974). Results showed that the Q2 values for Self-efficacy was 0.094; Perfomance was 0.011; and Postponement, 0.571. These values indicate a moderate predictive relevance (Hair et al., 2021).

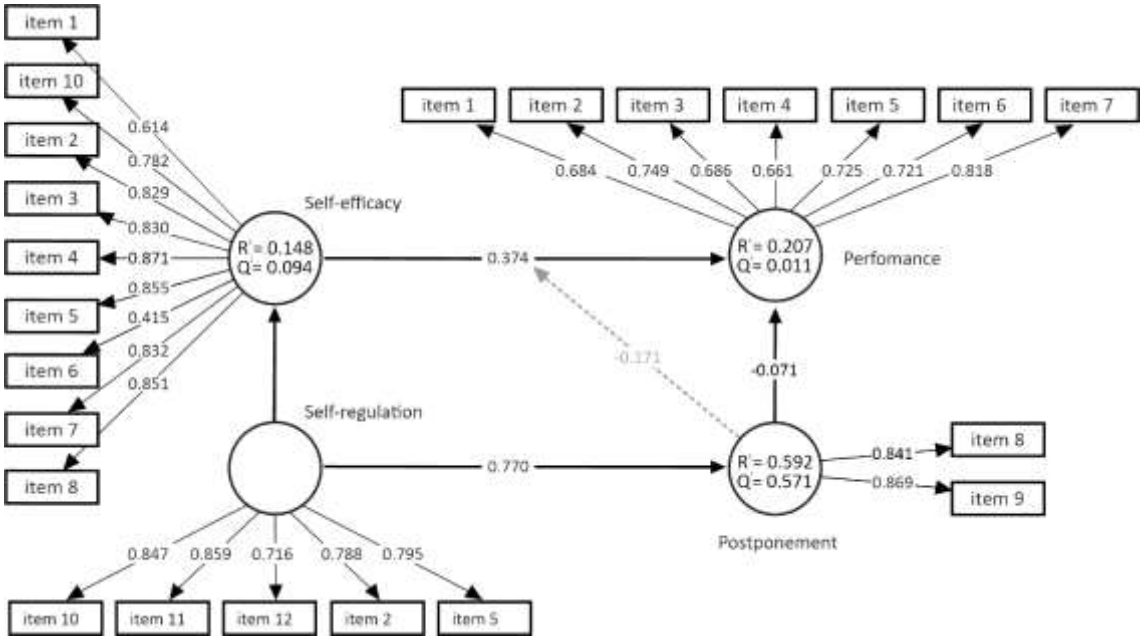

Figure 2. PLS path model and estimation results

Table 2 shows Cronbach's alpha (α), the external loadings (rho_A or Dijkstra Henseler index), the composite reliability index (IFC or Dillon-Goldstein's index) and the Average Variance Extracted (AVE), where the values must be greater than 0.5 (Becker et al., 2018).

That is, a high value of AVE will have a better representation of the load of observable variable.

Table 2. Convergent validity.

Variable	*α*	Rho_A	Composite Reliability Index (IFC)	Average Variance Extracted (AVE)
Self-efficacy	0.914	0.935	0.930	0.604
Self-regulation	0.862	0.879	0.900	0.644
Postponement	0.734	0.638	0.845	0.732
Perfomance	0.854	0.882	0.884	0.522

Note: (1) Cronbach's alpha coefficient = α

Calculating discriminant validity (Table 3) according to the Fornell-Larcker criterion and Heterotrait-Monotrait ratio (HTMT), involves comparing the square root of AVE with the correlations.

To obtain satisfactory discriminant validity, the diagonal elements for the Fornell-Larcker criterion must be significantly higher than the off-diagonal elements in the corresponding rows and columns (Fornell & Larcker, 1981). Likewise, the HTMT ratio shows the difference among the latent variable of each factor with respect to the others (Martínez-Ávila & Fierro-Moreno, 2018). Given that the HTMT values obtained are below 0.85, the research meets the criteria (Henseler et al., 2015).

Table 3. Measurement model. Discriminant validity

Fornell–Larcker criterion	1	2	3	4	5
1. Self-efficacy	**0.777**				
2. Self-regulation	0.384	**0.803**			
3. Postponement	0.287	0.770	**0.855**		
4. Perfomance	0.403	0.143	0.078	**0.722**	
Heterotrait-Monotrait Ratio (HTMT)	**1**	**2**	**3**	**4**	**5**
1. Self-efficacy					
2. Self-regulation	0.418				
3. Postponement	0.362	0.596			
4. Perfomance	0.389	0.233	0.230		
5. Postponement x Self-efficacy	0.234	0.269	0.236	0.317	

The results of the hypothesis testing are shown in Table 4. The criteria of Hair et al. (2021) were followed to test the effect. The t-test was obtained (values greater than 1.96 indicate the adequacy of the reflective model).

The significant results were:

Self-efficacy -> Perfomance (β = 0.374, t = 3.556, p<.001);

Self-regulation -> Self-efficacy (β = 0.384, t = 2.794, p<.001);

Self-regulation -> Postponement (β = 0.770, t = 21.156, p<.001);

Postponement x Self-efficacy -> Perfomance (β = -0.171, t = 2.218, p<.001)

The effect sizes for these variables support the proposed hypotheses, being the largest effect Self-regulation.

Table 4. Path coefficient (standardized regression coefficient).

Relation between variables	Path coefficient (β)	Standard deviation (σ)	t-statistic	95% bootstrap confidence intervals (paths)	*p*
Self-efficacy -> Perfomance	0.374	0.105	3.556	[0.204; 0.581]	***
Self-regulation -> Self-efficacy	0.384	0.138	2.794	[0.102; 0.628]	***
Self-regulation -> Postponement	0.770	0.036	21.156	[0.698; 0.841]	***
Postponement -> Perfomance	-0.071	0.138	0.512	[-0.333; 0.220]	0.608
Postponement x Self-efficacy -> Perfomance	-0.171	0.077	2.218	[-0.301; 0.003]	***

Note: *=p<.05; **= p<.01; ***=p<.001.

Necessary Condition Analysis (NCA)

To contrast the results of the structural model, the necessary conditions of the Perfomance variable were analyzed. Effect sizes for variables Self-efficacy, Self-regulation and Postponement were studied. Prediction parameters Ceiling Envelopment-Free Disposal Hull (CE-FDH) and Ceiling Regression-Free Disposal Hull (CR-FDH) were analyzed. The accuracy parameters are used to test the necessary conditions of the model on the data set. (Dul et al., 2020).

To identify the necessary conditions, three main criteria must be considered. (Dul et al., 2020). First, there must be a theoretical justification for the hypothesized relationship between predictor and outcome variables. Secondly, the NCA effect size must be greater than zero. Finally, the conditions must be tested against the null hypothesis to avoid false positives. To achieve this, a bootstrap approach can be applied, where the necessary condition is compared to the result using a permutation test. For the relationship to be considered significant, it must have a small p-value ($p < 0,05$) (Richter et al., 2020; Sujov et al., 2022). The reference scores obtained in the PLS-SEM analysis will be the starting point (Table 5). The recommended boundary line will be CR-FDH.

Table 5. NCA effect sizes

Construct	CE-FDH	*p*-value	CR-FDH	*p*-value
Self-regulation	0.340	***	0.289	***
Postponement	0.230	***	0.183	***
Self-efficacy	0.350	***	0.294	***

Note: *=p<.05; **= p<.01; ***=p<.001.

Among these conditions, Self-efficacy demonstrated the largest effect size ($d = 0.294$; $p < 0.01$), followed by Self-regulation ($d = 0.289$; $p < 0.01$) and Postponement ($d = 0.183$; $p < 0.01$); which shows a medium effect size range ($0,1 \leq d \leq 0,3$) (Dul et al., 2020) (Figure 3).

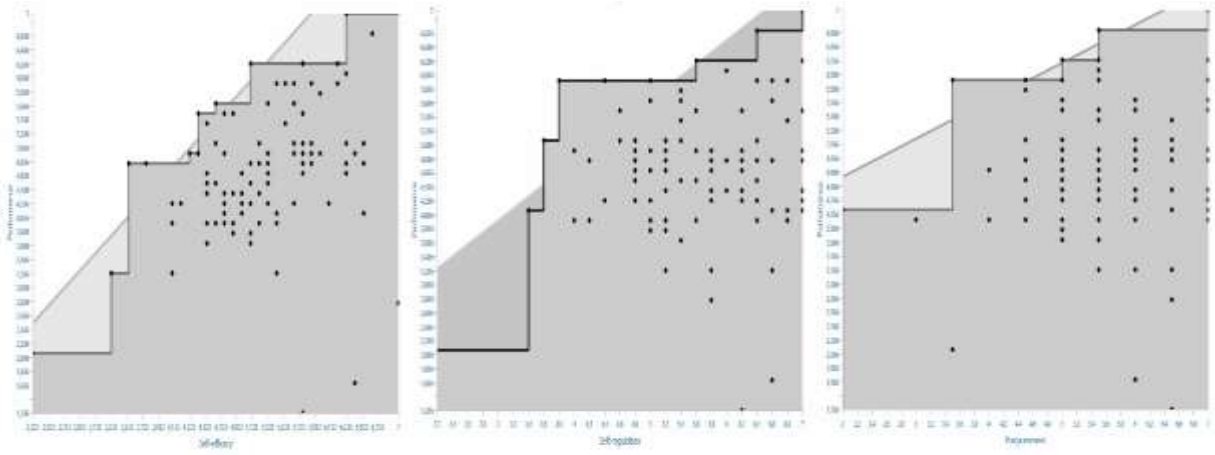

Figure 3. Visualization of the necessity analysis conducted among Self-efficacy, Self-regulation and Postponement.

To achieve a deeper understanding of the predictive level of the dimensions Self-efficacy, Self-regulation and Postponement with Perfomance, a Bottleneck table was made with the minimum values expressed as percentages needed to achieve a higher performance (50 %) (Table 6).

The results show that the variables Self-efficacy, Self-regulation and Procrastination are significant. ($d \geq 0.1$), necessary conditions for the variable Perfomance ($p < 0.01$), analyzed in Bottleneck table, determined by the following necessary conditions: Self-regulation (2.505.), Postponement (2.181.) and Self-efficacy (2,674).

Table 6. Bottleneck table (percentages)

	Perfomance	**Self-regulation**	**Postponement**	**Self-efficacy**
0.000%	1.286	NN	NN	NN
10.000%	1.857	NN	NN	NN
20.000%	2.429	NN	NN	NN
30.000%	3.000	NN	NN	2.674
40.000%	3.571	2.505	NN	3.132
50.000%	4.143	3.170	NN	3.591
60.000%	4.714	3.835	2.181	4.049
70.000%	5.286	4.500	3.233	4.507
80.000%	5.857	5.165	4.284	4.966
90.000%	6.429	5.830	5.336	5.424
100.000%	7.000	6.495	6.388	5.883

Note: NN = no necessary level

The variable with the greatest impact on Performance in the PLS-SEM analysis was Postponement. However, the results of the NCA show that certain determinants were not identified, being Self-efficacy, Self-regulation and Postponement necessary conditions for a better Performance of 50%.

Discussion

This study shows show different constructs linked to personal skills in the academic field are related to academic performance in university students. All the proposed hypotheses are confirmed, verifying the proposed model, which is of great interest since it leads to know the different variables related to academic performance.

The data obtained show that self-efficacy and self-regulation are variables related, as shown in previous studies. (Kohler, 2009; Flores-Araya et al., 2022; Gómez-Martínez & Romero-Medina, 2019; Pajares, 2001 and Zimmerman & Martínez-Pons, 1990). The use of metacognitive strategies linked to self-regulation leads students to use different techniques, improving the learning process and, after a number of positive experiences, the person's beliefs about his or her academic effectiveness are likely to increase.

On the other hand, it has been shown that self-regulation is a dimension of procrastination along with postponement. A deficit in students' metacognitive skills leads to worse control of their learning and academic activities, starting with a poor planning of their academic goals, which causes them to postpone their homework. The above shows that postponement and self-regulation are variables that shape procrastination, as previous studies have also shown (García-Martínez & Silva-Payró, 2019; Westgate et al., 2017).

The data obtained show that students with high self-efficacy have better academic results, as confirmed by previous studies. (González-Benito et al., 2021; Gómez-Martínez & Romero-Medina, 2019). Build good beliefs about the effectiveness of learning is a motivational process that will lead the student to feel competent and confident in their skills

and abilities. This will increase his/her motivation and expectations for him/herrself. Moreover, this higher motivation will lead to a positive appraisal of the tasks performed, which gives rise to a feeling of accomplishment of the proposed objectives and will lead to an improvement in performance in the medium term.

In addition, procrastination will influence the relationship between academic performance and self-efficacy. It is considered that in order to have a good academic performance it is necessary to have high self-efficacy and high self-regulation of learning, but low procrastination, being this latter variable the one that modulates the relationship to a greater extent. Therefore, those students who procrastinate to a lesser extent have appropriate and adjusted beliefs about their learning and, in addition, use strategies to check their progress on academic tasks, which will have a positive impact on their academic performance. These results are corroborated by those obtained by Klassen et al. (2008), who found that self-efficacy and self-regulation are predictor variables of procrastination, since students who procrastinated more were less confident in their ability to regulate their learning. It is clear that procrastination has a series of negative consequences in terms of grades, since starting activities late leads to tasks being performed in an urgently, causing feelings of stress and anxiety and, probably, low-quality activities. In the long term, all the above will have an impact on the students' motivation, affecting their learning own conception.

These results are interesting from an academic point of view, since knowing how students' academic performance may be affected by procastination provides data to improve it. Higher education is an investment for the social and economic growth of a country, since there is clear a relationship between the schooling rate of the nation's inhabitants and its economic development (OECD, 2011). Therefore, poor academic performance is not only a problem for students and their families, but also an economic problem due to the public spending involved. Thus, given that the improvement in university studies entails an improvement in student learning, it is important to implement all aspects that influence the learning process. This implies that we must not only teach content or skills related to intelligence or knowledge acquisition, but also promote students' self-regulation beliefs and abilities so that they can control their learning throughout their lives (Bandura, 1997; Zimmerman, 1995). The fact that the student can learn by him/herself implies that he/she acquires the competence to reflect on his/her own learning, and adapt this experience to the different contexts he/she faces. This is a basic competence that promotes quality learning (Ramsden et al., 2007).

Self-efficacy can be developed by students, which improves their beliefs, and gives them the opportunity to increase their academic performance. (Galleguillos & Olmedo, 2017). The same goes for self-regulation, which helps students to develop activities and strategies to avoid procrastination. Training in these dimensions helps students to know what they can do and how they can do it, although they need to put it into practice and get experience with good results.

In conclusion, it is necessary to indicate that university students should have at their disposal programs that develop their self-efficacy and self-regulation capacities, as well as learn strategies that help them not to postpone academic tasks. This will increase academic success at the university level by promoting comprehensive learning. Likewise, it will strengthen young people, enabling them to be better professionals in the future, not only from an academic point of view, but also in the workplace. In this way, public spending on education will be reverted to society itself.

However, this work has some limitations. The first and most important, was the restricted nature of the questionnaire within the academic performance model, which may have biased the results due to its relevance. In addition, having the responses of students from a single educational institution may limit the generalizability of results. Therefore, the results obtained should be taken with caution. Secondly, future studies should address

experimental or quasi-experimental designs to delve into the relationships found. Third, the sample size could be larger and achieve greater representativeness. Likewise, the type of sampling used was non-probabilistic by convenience and with voluntary inclusión so, it may present some type of proximity bias. Future studies should further randomize the sample selection. Finally, it is recommended to develop longitudinal studies to establish causal relationships among variables. This type of study would make it possible to alleviate the aforementioned limitation regarding access to information on academic performance by identifying the student. It would also allow researchers to know which factors can better explain the necessary conditions process. It would be interesting to replicate the research and learn about other university contexts in order to broaden the knowledge and the relationship among variables.

This work has important strengths, such as being the first to address the Necessary Condition Analysis (NCA) from a methodological perspective focused on Partial Least Squares Structural Equation Modeling (PLS-SEM) in the context of higher education, which has allowed us to demonstrate the relationships established among each of the dimensions studied.

On the other hand, the implications of this research, encourage to continue working from the university context in the promotion and strengthening of self-efficacy and self-regulation strategies, to enhance and improve academic performance (Gómez-Martínez & Romero-Medina, 2019), which is a fundamental factor to minimize students' procrastination processes.

Declarations

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