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THE PROTECTIVE ROLE OF INTRINSIC MOTIVATION, SELF-EFFICACY, AND SELF-REGULATION STRATEGIES AGAINST PROCRASTINATION AND STATISTICS ANXIETY

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THE PROTECTIVE ROLE OF INTRINSIC MOTIVATION, SELF-EFFICACY, AND SELF-REGULATION STRATEGIES AGAINST PROCRASTINATION AND STATISTICS ANXIETY

Abstract. *Statistics anxiety (SA) is a common problem among Health and Social Science students, and it has negative consequences for their performance. Dispositional antecedents of SA, such as intrinsic motivation, self-efficacy, and some specific individual behaviors, have been widely studied; however, the interplay between these variables in explaining SA has hardly been explored. This study aimed to examine the mediating role of individual behaviors (learning strategies and procrastination) in the effect of self-efficacy and internal motivation on SA. A sample of 194 Social and Health Science students filled in a questionnaire on statistics anxiety, intrinsic motivation, self-efficacy, learning strategies, and procrastination. Serial and parallel multiple mediator analyses showed that the effect of intrinsic motivation and self-efficacy on SA was mediated by the use of self-regulation learning strategies and procrastination. This study highlights the role of dispositional antecedents of SA and, specifically, the importance of promoting self-regulation learning strategies rather than cognitive learning strategies to minimize procrastination and reduce SA.*

Keywords: *statistical anxiety, motivation, self-efficacy, learning strategies, procrastination.*

1. INTRODUCTION

The use of knowledge and skills related to statistics is common in the academic curriculum of different disciplines, such as Health or Social Sciences. However, evidence shows that social science students tend to react negatively to statistics and that statistical topics can induce distress (Paxton, 2006). Although attaining knowledge in these areas is indispensable and provides students with a quality academic background, they usually encounter some obstacles that hinder their acquisition of these important skills. One of these difficulties is a type of anxiety called *Statistical Anxiety* (SA), understood as a negative state of emotional arousal and concern experienced by individuals when dealing with statistics, which is distinct from mathematics anxiety (Chew & Dillon, 2014; Onwuegbuzie & Wilson, 2003; Zeidner, 1991). This adverse reaction may occur in different situations: a) when taking statistics exams; b) when asking for help to the teacher or another student; and c) when they have to interpret statistical data and understand the formulation used in statistics (Vigil-Colet et al., 2008). Hence, among students, this translates into difficulties, tenseness, and nervousness associated with handling, solving, analyzing, and/or interpreting any type of statistical data (Macher et al., 2012). The available evidence has pointed out the impact of SA on academic performance, showing its association with low statistical performance (Abad et al., 2015; Macher et al., 2013; Paechter et al., 2017). Consistently, SA is widely identified as an explanation for students' reluctance to engage in or pursue statistics in their Social Science degrees (Chew & Dillon, 2014). Despite its interference, the mechanisms and processes underlying SA still require further exploration (Cui et al., 2019).

In this regard, previous research has identified several antecedents of SA that can be summarized in three main categories (Cui et al., 2019): situational, dispositional, and cognitive antecedents. Situational antecedents refer to factors related to a stimulus object or event, such as the characteristics of the class or the teacher; dispositional antecedents are related to individual factors, such as attitudes, motivation and experience, specific behaviors, and individual characteristics. Finally, cognitive antecedents include factors related to the underlying triggers of SA, such as attention, language processing, and applied strategies in the learning process.

Much of the research has focused on dispositional antecedents of SA, specifically the role of internal goal orientation or self-efficacy. On the one hand, a negative association between *intrinsic motivation* and SA has been consistently found, showing that students who are more motivated to acquire knowledge suffer less from SA and its consequences (Baloğlu et al., 2017; Siadat et al., 2014). Additionally, Lavasani et al. (2014) found that an internal goal orientation could affect SA through higher academic motivation and better use of learning strategies. In line with this, some evidence have pointed out that the association between motivation and SA could be mediated by the use of learning strategies (i.e., metacognitive and cognitive strategies) (Lavasani et al., 2011). Consistently, previous studies have found that learners develop more positive emotions and employ more appropriate learning strategies when they are intrinsically motivated to learn the content (Linnenbrink-Garcia et al., 2016).

On the other hand, *self-efficacy* to learn statistics can be understood as an individual's confidence in his or her ability to successfully learn the necessary statistical skills in a statistics course (Finney & Schraw, 2003). Regarding its relationship with SA, different studies have found a negative association, indicating that individuals with a higher level of self-efficacy experience less SA (Baloğlu et al., 2017; Ogbogo & Amadi, 2018; Perepickza et al., 2011). Self-efficacy is a crucial motivational variable that has been shown to exert a relevant influence not only on performance, but also on a large number of academic outcomes, such as the person's interest or effort and persistence when encountering difficulties (Bandura, 1997). In this sense, although the direct association between self-efficacy and SA seems to be established in the literature, the variables that could be involved in this relationship have hardly been explored. Studies in other subjects where academic anxiety is present, such as learning mathematics or English as a foreign language, have shown interesting findings, suggesting an association between self-efficacy, self-regulation learning strategies, and performance (Sun & Wang, 2020).

Another group of dispositional antecedents of SA is related to some specific behaviors, in which *procrastination* -understood as a purposeful and unnecessary delay in completing classwork that is detrimental to academic outcomes (Zhao & Elder, 2020)- has received special attention. In the academic domain, procrastination is a pervasive self-regulatory failure, and it is a serious barrier that affects approximately half of the student population and keeps them from achieving their academic goals (Rozental & Carlbring, 2014; Steel, 2007). Some of the negative effects that accompany procrastination include anxiety and high levels of stress, but also poor sleep, late work due to lack of time, improper completion of homework, confusion, feelings of guilt and inadequacy, self-blame, low self-esteem, and depression (Custer, 2018). More specifically, in relation to SA, evidence shows a bidirectional association between SA and procrastination. Thus, individuals with higher levels of SA tend to procrastinate, but at the same time, the avoidance of these aversive tasks reinforces statistics fear and SA (Rodarte-Luna & Sherry, 2008; Vahedi et al., 2012).

Moreover, the use of *self-regulation learning strategies* (i.e., metacognitive strategies of planning, skimming, or comprehension monitoring when trying to learn) arises as another individual behavior antecedent of SA. Meta-cognitive strategies are crucial in learning because they help students focus their attention on understanding, encoding, and processing the content, as well as linking it to previous and new knowledge and skills (Lavasani et al., 2011). Vahedi et al. (2012) found that SA was predicted not only by procrastination, but also by the use of self-regulation learning strategies. Furthermore, several studies have associated attitudes, motivation, and experience characteristics with individual behaviors in explaining SA. For instance, in the study by Macher et al. (2012), the interest in statistics -the most salient attitude towards statistics- was related to the use of more efficient learning strategies, which led to improved statistics performance. Consistently, Kesici et al. (2011) found a positive association between the presence of more positive attitudes towards statistics (or less SA) and the use of different *cognitive strategies* (i.e., rehearsal, elaboration, organization, critical thinking,

metacognitive regulation, ability to manage time and the study environment) to regulate their effort in learning statistics. Along these lines, Dunn (2014) studied the influence of intrinsic motivation and self-regulation (that is, the monitoring, regulation, and control of one's cognition, motivation, and behavior in order to achieve a goal) on procrastination. Results showed that both of these factors, but especially academic self-regulation, had a strong influence on procrastination. This finding sheds light on the importance of the relationship between different dispositional antecedents, such as internal orientation, self-efficacy, and some individual behaviors (e.g., learning strategies and procrastination), in explaining SA.

These results highlight the need to further explore the predictive role of SA dispositional antecedents (Bourne, 2018) and, especially, the interplay between them. Therefore, this study aims to explore the predictive role of several dispositional antecedents of SA in a sample of Social and Health Science students. More specifically, the objectives were: (1) to analyze the relationships between the dispositional variables and SA; and (2) to examine the possible mediating role of individual behaviors (e.g., learning strategies and procrastination) in the interplay between attitudinal and motivational antecedents (e.g., self-efficacy and internal motivation) and SA. To do so, we decide to control the effect of gender as a confounding factor in this mediational analysis given the previous evidence regarding gender differences on SA -the main outcome of the model-. A recent systematic review conducted by Trassi et al. (2022) on the mediating factors of SA in university students showed a higher tendency among women to report SA.

We hypothesized that the use of learning strategies (self-regulation and cognitive strategies) and procrastination would play a mediating role in the association between intrinsic motivation and SA (Hypothesis 1), and the association between self-efficacy and SA (Hypothesis 2). This study will help us to determine whether behavioral variables are potential explanatory mechanisms involved in the impact of dispositional variables on SA. Thus, we will shed light on the possibility of reducing SA by intervening in behavioral aspects (or the actions students can engage in), without the need to intervene in attitudinal or motivational aspects.

2. METHOD

2.1. PARTICIPANTS

The sample was composed of 194 Social and Health Science students (56.7% females), mostly undergraduates (99.1%) from the University of Valencia (Spain, 79.4%). Their ages ranged from 18 to 42 (M = 20.87, SD = 2.71). All participants had to be studying a degree or master's degree in Social or Health Sciences and have at least one statistics course as a part of their academic curriculum (i.e., 53.1% from Social Sciences and 46.9% from Health Sciences).

Demographic characteristics and academic-related variables are shown in Table 1. Most of the participants were studying the Social and Health Science degree in-person (75.8%), the most recent mark in Mathematics or Statistics was "very good" (48.5%), their average self-perceived mark in Mathematics or Statistics was "very good" (54.1%), and they had studied one (39.2%) or two subjects (37.1%) in Statistics thus far.

Table 1: Descriptive statistics of the study variables (n = 194)

	M (SD)/ %
Age	20.87 (2.72)
Sex (% of women)	56.7%
Year of the academic degree	
First	19.4%
Second	29.4%
Third	28.3%
Fourth	21.1%
Fifth	1.7%
Modality of the degree	
In-person	75.8%
Blended	21.1%
Online	3.1%
Most recent mark in Mathematics or Statistics	
Failed (< 5)	5.2%
Passed (5-6.99)	32.5%
Very good (7-8.99)	48.5%
Excellent (>9)	13.9%
Self-perceived average mark in Mathematics or Statistics in the past	
Failed (< 5)	1.5%
Passed (5-6.99)	28.4%
Very good (7-8.99)	54.1%
Excellent (>9)	16.0%
Number of Statistics subjects taken so far	
One	39.2%
Two	37.1%
Three	15.5%
Four	7.2%
More than five	1.0%

2.2. PROCEDURE

Participants were contacted through the recruitment service "Lineex" (https://www.lineex.es/en/home/) to participate in a study related to "Variables related to Statistics". The platform used to conduct the survey was LimeSurvey (enquestes.uv.es). The participants only answered the survey once, which took about 15-20 minutes, and participation was completely anonymous. To ensure the quality of the responses, we embedded "control questions" in the survey in order to check participants' attention (e.g., "We want to check your attention. Respond "5" if you are reading this"). If they made a mistake on these questions, they were dropped from the survey.

Participants read and signed the informed consent before starting the survey, and they received 5€ as compensation. The study was carried out in accordance with the Helsinki Declaration on ethical criteria in research, and it was approved by the Ethics Committee of the University of Valencia (register number 1768355).

2.3. MEASURES

Statistical Anxiety (SA): *The Statistical Anxiety Scale* (SAS, Vigil-Colet et al., 2008; Oliver et al. 2014). This is a 24-item instrument designed to assess three factors of SA towards: (1) Examinations (i.e., anxiety when taking statistics exams); (2) Asking for Help (i.e., anxiety when asking the course teacher or other students questions about statistics); and (3) Interpretation (i.e., anxiety when interpreting statistical data and understanding the formulations used in statistics). It is responded to on a 5-point Likert scale (1 = "no anxiety"; 5 = "considerable anxiety"), with higher scores indicating higher levels of SA. The total mean scores ranged from 1 to 5. In this study, the internal consistency was adequate for all the subscales (Cronbach's α ranged from .82 to .93) and the total score (α = .92). According to the hypotheses of the study, we only used the total score in the analyses, as we were interested in the full construct of SA, including all the situations in which SA may occur. Moreover, the total score has shown an adequate reliability in the Spanish validations by Vigil-Colet et al. (2008) (α = .91) and Oliver et al. (2012) (α = .91), in which the three dimensions correlated with each other, being considered associated subscales from an overall scale measuring SA.

Intrinsic Motivation (IM), Self-efficacy (SE), and Learning Strategies (Self-Regulation and Cognitive Strategies): *Motivated Strategies for Learning Questionnaire short form* (MSLQ-SF, Pintrich & DeGroot, 1990; Albert, 2017). This is a 44-item measure, on which individuals respond using a 5-point Likert scale that ranges from 1 ("Strongly disagree") to 7 ("Strongly agree"). This questionnaire has five subscales: *Self-efficacy* (i.e., perceived competence and confidence in performing class work), *Intrinsic Value* (i.e., intrinsic interest in and perceived importance of course work), *Test Anxiety* (i.e., worry about tests), *Cognitive strategy Use* (i.e., the use of rehearsal strategies, elaboration strategies -summarizing or paraphrasing-, and organization strategies), and *Self-Regulation Use* (i.e., meta-cognitive strategies, such as planning, skimming and comprehension monitoring). "Test Anxiety" subscale was not included in the analyses, given the expected large correlation between this scale and the subscale "examinations" of the SAS scale (i.e., anxiety when taking statistics exams). The mean scores for each factor ranged from 1 to 7. The Spanish version validated by Albert (2017) had adequate internal consistency (Cronbach's α ranging from .70 to .89). In this study, all the subscales were used, except "Test Anxiety", and they all showed adequate internal consistency (Self-efficacy: α = .90; Intrinsic Value: α = .88; Cognitive strategy Use: α = .80; and Self-Regulation Use: α = .72).

Procrastination: *Academic Procrastination Scale-Short Form* (APS-SF, McCloskey 2011; Yockey, 2016; Brando-Garrido et al., 2020). This is a 5-item questionnaire on which items are answered using a 5-point Likert scale, ranging from 1 (strongly agree) to 5 (strongly disagree). The total score ranges from 5 to 25, with higher scores indicating a greater tendency to postpone academic tasks. The APS-SF has shown high reliability, with Cronbach's α = .87 (Yockey, 2016). The Spanish version validated by Brando-Garrido et al. (2020) showed a good level of internal consistency, with Cronbach's α = .87. In this study, internal consistency was adequate for the total score (α = .85).

2.4. DATA ANALYSES

All statistical analyses were performed using the SPSS v.26. First, descriptive statistics of the sociodemographic and academic-related variables were conducted. There were no missing values in the database given that it was mandatory to answer all the items in the online platform. Second, Pearson's correlations and scatter plots were conducted to analyze relationships among the study variables. Third, two serial and parallel multiple mediator analyses were performed with the macro PROCESS version 4.0 for SPSS v.26 (Hayes, 2017). PROCESS is a modelling tool to compute ordinary least squares (OLS) regression-based path analyses and is especially useful to estimate direct and indirect pathways through which an antecedent variable *X* is related to a consequent variable *Y.* In this mediational model, multiple mediators were included "serially" (i.e., to test whether the mediators were linked together in a causal chain as shown by the specific indirect effects) and "parallelly" -in the case of the learning strategies- (i.e., to test whether "cognitive strategies" and "self-regulation strategies" were mediators of the model not influenced among them). Including parallel mediators allow to compare the size of the indirect effects in case of being significant (see Hayes, 2017, p. 147-186). Specifically, two models 80 (Hayes, 2017) were tested: (1) *Model 1:* Intrinsic motivation (*X*) → Cognitive strategies (M_1) /Self-regulation strategies (M_2) → Procrastination (M_3) → Statistics Anxiety (*Y*); and (2) *Model 2:* Self-efficacy (*X*) → Cognitive strategies (M_1) /Self-regulation strategies (M_2) → Procrastination (M_3) → Statistics Anxiety (*Y*). The following equations specify the direct and indirect effects of intrinsic motivation and self-efficacy in their respective models:

$M_1 = i_{M1} + a_1X + e_{M1}$ (1)

$M_2 = i_{M2} + a_2X + e_{M2}$ (2)

$M_3 = i_{M3} + a_3X + d_{31}M_1 + d_{32}M_2 + e_{M3}$ (3)

$Y = i_Y + c'X + b_1M_1 + b_2M_2 + b_3M_3 + e_Y$ (4)

i_{M1}, i_{M2}, i_{M3}, and i_Y indicates the intercept of M_1, M_2, M_3, and *Y*, respectively; a_1, a_2, *and* a_3 indicate the increase estimated on M_1, M_2, and M_3, respectively, by one unit increased on *X*; d_{31} *and* d_{32} indicate the increase estimated on M_3 by one unit increased on M_1 and M_2, respectively; *c'* is the direct effect of X; and b_1, b_2, and b_3 are the coefficients of the indirect effects of M_1, M_2, and M_3, respectively.

The five models representing the five specific indirect effects of each model were inspected: (1) *indirect effect 1:* Intrinsic motivation or Self-efficacy (*X*) → Cognitive strategies (M_1) → Statistics Anxiety (*Y*); (2) *indirect effect 2:* Intrinsic motivation or Self-efficacy (*X*) → Self-regulation strategies (M_2)→ Statistics Anxiety (*Y*); (3) *indirect effect 3:* Intrinsic motivation or Self-efficacy (*X*) → Procrastination (M_3)→ Statistics Anxiety (*Y*); (4) *indirect effect 4:* Intrinsic motivation or Self-efficacy → Cognitive strategies → Procrastination → Statistics Anxiety (*Y*); (5) *indirect effect 5:* Intrinsic motivation or Self-efficacy (*X*) → Self-regulation strategies (M_2) → Procrastination (M_3)→ Statistics Anxiety (*Y*). Moreover, other effects were also explored: a) the direct effect of X on Y; b) the total indirect effect of X on Y (i.e., the sum of the specific indirect effects); and c) the total effect of X on Y (i.e., the sum of the indirect effect and the direct effect). Percentile bias-corrected bootstrap confidence intervals, 95% CI, based on 5,000 samples were used. Gender was entered as a covariate in the model, given the effect

of gender on SA found in the previous literature (Trassi et al., 2022) and the higher scores that we found in SA among the women of the present study, $t(192) = 4.23$, $p < .001$. The indirect or mediational effects were considered statistically significant when the indirect effect did not include the zero-value. The assumption of linearity between the variables in the model was checked with scatter plots. Independence of the errors in estimation of the dependent variable can be assumed because the sample is not composed of different subsets of cases nor was recruited sequentially. Since bootstrapping is used, assumptions of *normality* and *homoscedasticity* of the errors in the estimation of the dependent variable do not need to be met. Finally, *post hoc* power analyses were computed to determine the statistical power for the indirect and total effects in the tested models. To do so, Monte Carlo simulation with 5,000 repetitions were conducted using the *pwrSEM* app on Shinny (Wang & Rhemtulla, 2021).

3. RESULTS

3.1. PEARSON'S CORRELATIONS AMONG THE STUDY VARIABLES

Results for Pearson's correlations are shown in Table 2. Statistics anxiety (SAS) was negatively correlated with intrinsic motivation (MSLQ-SF) and self-efficacy (MSLQ-SF), whereas it was positively correlated with procrastination (APS-SF). However, statistics anxiety was not associated with the use of cognitive or self-regulation strategies ($p > .05$).

Regarding intrinsic motivation and self-efficacy (MSLQ-SF), both variables were positively correlated with the use of cognitive and self-regulation strategies (MSLQ-SF), whereas they were negatively correlated with procrastination (APS-SF).

Finally, regarding the use of cognitive and self-regulation strategies (MSLQ-SF), both variables were negatively correlated with procrastination (APS-SF).

Table 2: Correlations between the study variables (N = 194)

	1	**2**	**3**	**4**	**5**	**6**
1. Statistics Anxiety (SAS)	-					
2. Intrinsic motivation (MSLQ-SF)	-.16*	-				
3. Self-efficacy (MSLQ-SF)	-.27***	.71***	-			
4. Cognitive strategies (MSLQ-SF)	-.01	.47***	.24**	-		
5. Self-regulation strategies (MSLQ-SF)	-.07	.48***	.32***	.69***	-	
6. Procrastination (APS-SF)	.17*	-.27***	-.23**	-.38***	-.55***	-
M (SD)	2.90 (0.63)	5.20 (0.97)	4.88 (0.97)	5.41 (0.81)	4.86 (0.84)	12.45 (4.80)

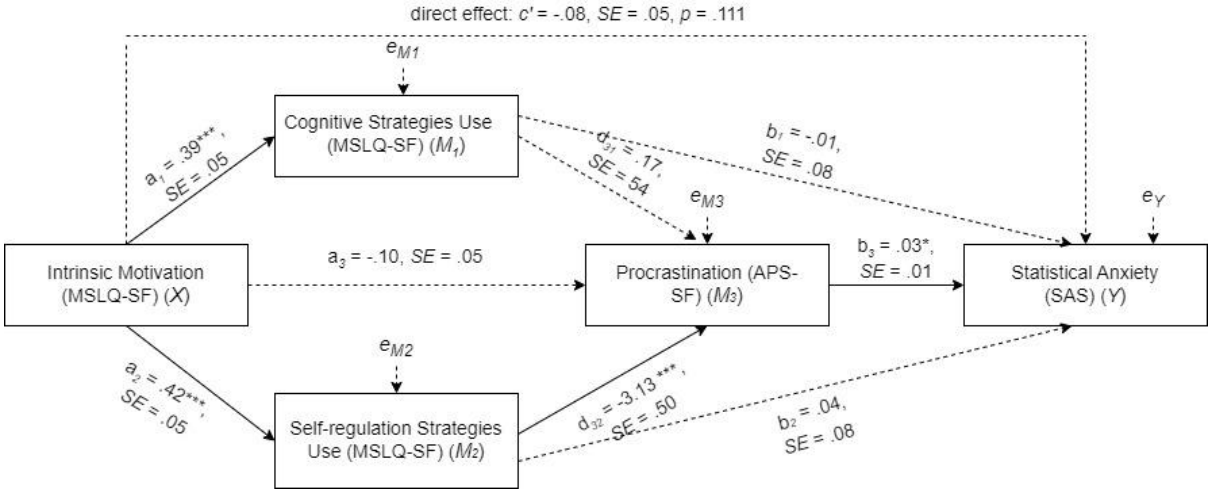
Notes. * p < .05; ** p < .01; *** p < .001. MSLQ-SF = Motivated Strategies for Learning Questionnaire short form; APS-SF = Academic Procrastination Scale-Short Form; SAS =The Statistical Anxiety Scale.

3.2. SERIAL AND PARALLEL MULTIPLE MEDIATION ANALYSES

Intrinsic motivation as predictor. The total effect of the multiple and serial mediation analysis was significant, b = -.14, SE = 0.04, t = -2.40, p = .017. The *post hoc* power to detect the total effect was 70%. The total indirect effect was not significant, b = -0.02, SE = 0.04, 95% CI [-0.095, 0.048]. Only one specific indirect effect "Intrinsic motivation → Self-regulation strategies → Procrastination → Statistics Anxiety" (indirect effect 5) was significant, b = -.04, SE = 0.02, 95% CI [-0.079, -0.008]. That is, intrinsic motivation led to higher self-regulation (β = .48), which, in turn, led to less procrastination (β = -.55) and finally, to experiencing less statistical anxiety (β = .21). The *post hoc* power to detect this indirect effect was 8%. The rest of the indirect effects were non-significant (i.e., the 95% CI included the zero value). The multiple regression model including all the variables was significant, $F(5,187) = 6.49$, $p < .001$, and explained 14.78% of the variance in Statistics Anxiety. The direct effect of Intrinsic Motivation on Statistics Anxiety was non-significant, b = -.08, SE = 0.05, t = -1.60, p = .111. Hence, higher intrinsic motivation did not lead to less statistical anxiety when the three mediators remained unaltered (See Figure 1).

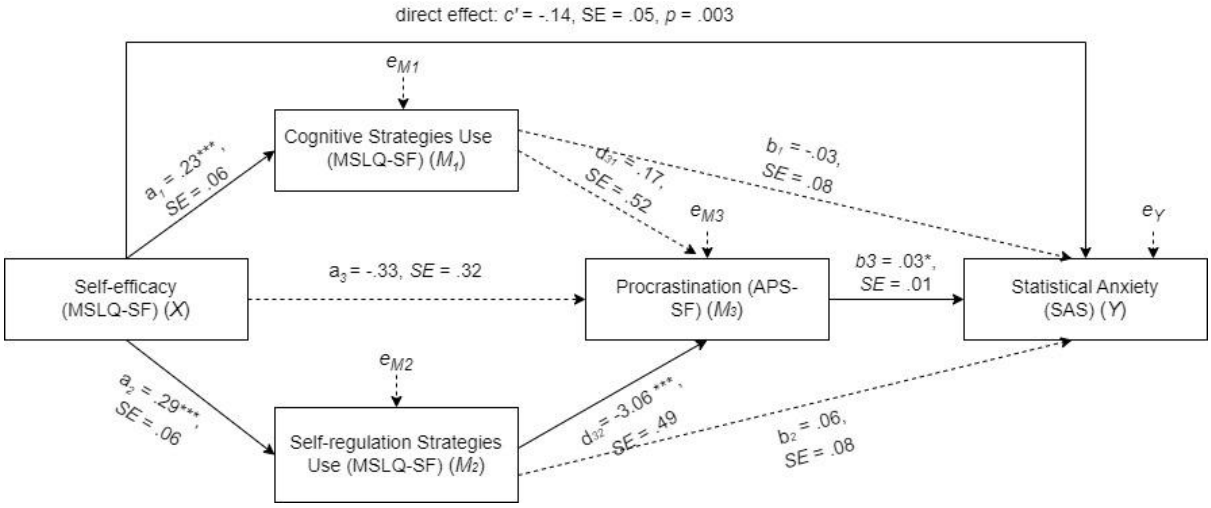
Self-efficacy as predictor. The total effect of the multiple and serial mediation analysis was significant, b = -.16, SE = 0.04, t = -3.68, p = .003. The *post hoc* power to detect the total effect was 6%. The total indirect effect was non-significant, b = -.02, SE = 0.02, 95% CI [-0.067, 0.017], but one specific indirect effect "Self-efficacy → Self-regulation strategies → Procrastination → Statistics Anxiety" (Model 5) was significant, b = -.02, SE = 0.01, 95% CI [-0.052, -0.003]. The *post hoc* power to detect this indirect effect was 6%. The multiple regression model including all the variables was significant, $F(5,187)$ = 8.02, $p < 0.001$, and explained 17.7% of the variance in Statistics Anxiety. Hence, higher self-efficacy led to higher self-regulation (β = .33), which, in turn, led to less procrastination (β = -.54) and finally, to experiencing less statistical anxiety (β = .20). The direct effect of Self-efficacy on Statistics Anxiety was also significant, b = -.14, SE = 0.05, t = -3.03, p = .003, explaining 14.7% of the variance (see Figure 2).

Figure 1. Parallel and serial mediation analysis: Intrinsic motivation as predictor



Notes. * $p < .05$; ** $p < .01$; *** $p < .001$. b = unstandardized regression coefficients; SE = standard errors; MSLQ-SF = Motivated Strategies for Learning Questionnaire short form; APS-SF = Academic Procrastination Scale-Short Form; SAS = The Statistical Anxiety Scale.

Figure 2. Parallel and serial mediation analysis: Self-efficacy as predictor



Notes. * $p < .05$; ** $p < .01$; *** $p < .001$. *b* = unstandardized regression coefficients; *SE* = standard errors; MSLQ-SF = Motivated Strategies for Learning Questionnaire short form; APS-SF = Academic Procrastination Scale-Short Form; SAS = The Statistical Anxiety Scale.

4. DISCUSSION

The aim of this study was to examine the interplay among different antecedents of SA in a sample of undergraduate Health and Social Sciences students. Considering the available evidence, we hypothesized that the dispositional variables would be associated with SA, and, specifically, the association of intrinsic motivation and self-efficacy with SA would be mediated by the use of cognitive and self-regulation learning strategies, as well as the level of procrastination.

The first hypothesis was partially supported. The effect of intrinsic motivation on SA was not direct because it was mediated by the use of self-regulation strategies and procrastination. Hence, in our study, a higher intrinsic value (i.e., importance or usefulness) given to Statistics was related to a greater use of self-regulated meta-cognitive strategies (i.e., the implementation of strategies to regulate their own understanding or processing of the information). In turn, the use of self-regulation strategies was related to a lower tendency to postpone academic tasks, and this lower procrastination was related to less SA.

The associations between intrinsic motivation, self-regulation strategies, procrastination, and SA have been consistently found in the literature. Regarding the effect of intrinsic motivation on self-regulation strategies, Macher et al. (2012) found that students who were interested in a specific topic tended to engage more in studying and use efficient learning strategies more often. This could be due to the fact that learning strategies involve considerable effort and time, and so less motivated students may rely less on the use of these strategies. Moreover, efficiency in the use of learning strategies has also been negatively associated with procrastination in samples of undergraduates in Human Science disciplines (Howell & Watson, 2007; Vahedi et al., 2012), pointing out that less use of metacognitive learning strategies leads to more procrastination. Similarly, Schouwenburg (2004) found a negative association between procrastination and an organized approach to one's work (i.e., one's time management, monitoring, or planning of the process), which may be an indicator of poor self-regulation strategies. Regarding the interactions between intrinsic motivation, use of self-regulation strategies, and procrastination, Rakes and Dunn (2010) found that less intrinsic motivation to learn and lower regulation effort were related to higher procrastination in an online program with a sample of graduated students. In a similar vein, Dunn (2014) found that intrinsic motivation and academic self-regulation were negatively associated with passive procrastination and SA in a sample of graduate students. Contrary to our proposal, in Dunn's (2014) model, SA led to procrastination (e.g., due to task

aversiveness). However, because the association between procrastination and SA seems bidirectional, our results could reinforce the evidence of a negative loop between procrastination and SA. That is, procrastination may also affect SA due to the increased difficulty and workload of the individual (Onwuegbuzie, 2004).

Regarding the second hypothesis, the results also partially supported the mediational model with self-efficacy predicting SA through self-regulation strategies and procrastination. Moreover, the direct effect of self-efficacy on SA was also significant, which is in line with previous studies showing that self-efficacy is one of the factors that influence SA in students (Perepiczka et al., 2011). Nevertheless, the explained variance of the indirect effect of self-efficacy on SA through self-regulation strategies and procrastination was slightly higher (i.e., 3% more explained variance). This reinforces the need to consider the individual behavioral variables in reducing SA, in addition to individuals' efficacy beliefs about their capability or interest in performing the subject tasks.

Overall, our findings highlight the importance of using self-regulation strategies (i.e., comprehension monitoring, goal setting, planning, and effort management and persistence) instead of cognitive strategies (i.e., the use of rehearsal, elaboration, and organizational strategies for memorizing and organizing) to prevent procrastination and, ultimately, SA. The mediational effect through the use of cognitive strategies was non-significant. That is, the self-regulated metacognitive strategies -or having active control over the cognitive processes involved in learning- stand out as crucial strategies for decreasing procrastination and SA. Consequently, to reduce SA, students must be able to understand "how" and "when" to use strategies appropriately, instead of just knowing "what" cognitive strategies they can use (Mayer, 1998). Furthermore, our model shows that the use of meta-cognitive strategies is mostly triggered in individuals with high self-efficacy and intrinsic motivation. In this regard, Statistics course teachers should identify the profiles of students who may benefit from reinforcing this meta-cognitive ability to overcome procrastination and SA through explicit metacognitive strategy instruction. In this regard, the meta-analysis by Donker et al. (2014) showed that learning strategy instruction was effective in improving academic performance in mathematics in primary and secondary education (Hedges' g = .66). Similar results were found in college students enrolled in developmental math courses, who benefitted from an intervention in self-regulated learning, improving math achievement, metacognitive self-regulation, and time/study environmental management skills (Bol et al., 2015). In the specific context of learning statistics, interventions that included self-regulated learning instruction (e.g., strategies for students to learn statistics with a growth mindset) showed to be effective to reduce statistics anxiety and increase performance (Jazayeri et al., 2022; Smith & Capuzzi, 2019). However, more research is needed to affirm that instruction in learning strategies is effective in reducing SA.

However, this study has some limitations. Findings should be viewed cautiously given the correlational nature of the study. Causal relationships between the study variables cannot be inferred. This is especially important in the case of the relationship between procrastination and SA because this link seems to be bidirectional (Onwuegbuzie, 2004). Future experimental and longitudinal studies should test whether improving learning strategies impacts procrastination and, in turn, SA, or the other way around. In addition, this study seems to be underpowered to detect significance in the effects examined, that is, potentially existing relationships in the population may not have been found in this study. Future studies should ensure sufficient statistical power to detect relevant associations between the study variables. Another limitation is related to the fact that this was a retrospective study. Future studies should use experience sampling methods to test whether the dispositional variables and individual behavior can predict anxiety during statistics exams, when asking for help, or in interpreting statistical data. This kind of assessment would allow us to assess the individuals in a natural setting and in real time, helping in delve into the dynamics of anxiety (Walz et al., 2014).

In conclusion, this study shows that dispositional variables related to intrinsic motivation and self-efficacy, along with the individual's behavior -in terms of self-regulation strategies and procrastination-, are associated with SA. Students with higher levels of interest and self-efficacy have dispositional protective variables that trigger adaptive behaviors that keep them from experiencing negative emotions and thoughts when dealing with the subject of Statistics. Moreover, this study also highlights the need to promote self-regulating metacognitive strategies for coping with Statistics, in order to reduce procrastination and anxiety.

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