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Procrastination and academic motivation among students before and during the Covid-19 pandemic

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Abstract

The study assessed undergraduates' procrastination and self-determined academic motivation during the Covid-19 pandemic compared with pre-pandemic times. Participants were 1,486 students attending public universities from Buenos-Aires-City-and-environs in Argentina (M_{age} = 26.74, SD = 7.88; 85% female, 15% male). A subtotal of 905 (61%) students participated pre-pandemic (January 2020) during face-to-face learning, and 581 (39%) participated during the pandemic (July 2021) during online learning. At both times, participants provided sociodemographic information and completed the Tuckman Procrastination Scale and the Academic Motivation Scale. Hierarchical multiple regression analyses were conducted to assess the relations between procrastination and academic motivation in students before compared to during the pandemic. A small but significant increase in procrastination was observed when comparing the pre- and during-pandemic groups: the risk of being classified as a procrastinator during the pandemic was estimated to be 22% higher (CI_{95} = 9%, 35%) compared with pre-pandemic times. Academic motivation was observed to remain stable, indicating evidence of minimal pre-during pandemic differences. Results suggest that, during the pandemic, procrastination in students rose, but academic motivation remained stable. These findings provide novel insights into psychological variables that affect student learning. In this vein, educators should be aware that students could procrastinate more within online learning contexts during a pandemic; thus, further research is needed to understand how to support students in this context.

Practitioner notes

1. Procrastination increased in undergraduates during the Covid-19 pandemic compared to before the pandemic.
2. Academic motivation levels of undergraduates were not significantly different before versus during the pandemic.
3. During a pandemic and within an online context, students who are already prone to procrastination may be particularly vulnerable to increased procrastination.
4. Educators should consider how to support students to avoid procrastination, particularly within online studying contexts.

Keywords

Procrastination, Academic Motivation, Covid-19, Pandemic, Online-Learning

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Introduction

The COVID-19 pandemic brought unprecedented challenges to higher education systems worldwide, affecting various aspects of students' academic experiences. Understanding the impact of the pandemic on key psychological variables that impact online learning, such as the tendency to procrastinate, and academic motivation, is highly relevant. The aim of the present study was framed within the theoretical context that motivation, as understood by self-determination theory, is known to affect procrastination (Tisocco & Fernández Liporace, 2023). In this vein, the main research question was: have procrastination and academic motivation among undergraduates changed since the advent of the pandemic? These findings will have implications for designing effective online learning environments in higher education during pandemic times.

A cross-sectional and exploratory design was employed to examine the changes in procrastination and academic motivation before and during the pandemic, as well as examine the relations between procrastination and motivation. Participants included undergraduate students from public universities in Buenos Aires City and its environs, with data collected in January 2020 (pre-pandemic) and July 2021 (during the pandemic). Given the potential influence of individual differences on procrastination and motivation, data analyses accounted for key sociodemographic and academic covariates—including civil status, job status, and living arrangements—to control for their confounding effects. This approach was undergone to enhance the comparability between pre- and during-pandemic groups — thus, it ensured that any observed differences were less likely to be driven by underlying demographic variations rather than the pandemic itself.

Literature

By February 2020, the World Health Organization declared the novel coronavirus (COVID-19) as a global health emergency, transitioning to a *pandemic* shortly after. A solution for the COVID-19-related disruption to higher education was a rapid transition to online-based learning settings (Adnan & Anwar, 2020; Aucejo et al., 2020) —approximately 90% of enrolled students worldwide were affected, and the majority of higher education institutions interrupted their activities (Marinoni et al., 2020). The distress-inducing scenarios of both the pandemic as a health crisis and the lockdown measures adopted by countries did not evade college students —higher levels of depression, anxiety and stress were reported by undergraduates after the irruption of the pandemic (e.g., Brooks et al., 2020; Cao et al., 2020; Elmer et al., 2020; Huckins et al., 2020; Usher et al., 2021).

Initially, the transition to online learning was depicted in the literature as well-received by students, comprised majorly of millennial and centennial generations —characterized by their readiness for online-based activities as per findings from Germany and Saudi Arabia (Khalil et al., 2020; Schlenz et al., 2020). However, acceptance of this mode of education came with several caveats. Studies have reported that undergraduates are frequently challenged with self-regulation-related problems within blended-learning contexts, such as, among others, general time management, procrastination, and lack of academic motivation (e.g., Pelikan et al., 2021; Rasheed et al., 2020; Yilmaz, 2017). The two latter variables —procrastination and academic motivation— prove particularly relevant since they belong to the motivational group of psychological variables which have shown a higher impact on academic performance, as per meta-analytical evidence (e.g., Hattie, 2008; Lee & Stankov, 2018). These latter studies found that, among all non-cognitive predictors of achievement, motivational variables such as educational aspirations, effort

regulation, and self-efficacy showed the largest effect sizes in terms of their association with academic achievement.

Academic procrastination can be briefly defined as a behavioural pattern involving the purposeful and unnecessary delay of academic tasks, even when the delay could account for adverse outcomes (Steel, 2007; Tuckman, 1991). This construct is typically assessed via self-report questionnaires (Kim & Seo, 2015), such as the Tuckman Procrastination Scale (TPS; Tuckman, 1991). It has been considered a highly dysfunctional academic behaviour (van Eerde & Klingsieck, 2018), systematically linked to worsened learning and academic performance, as well as psychological symptomatology such as anxiety and depression (Hussain & Sultan, 2010; Kim & Seo, 2015; Steel, 2007; Van Eerde, 2003). It has also been associated with a higher student dropout rate within online-learning environments (Michinov et al., 2011). Procrastination has also been described as a self-regulated motivational deficit or as a significant challenge for self-regulated learning —i.e., the process by which individuals control their thoughts, emotions, and behaviours to achieve their academic goals—(e.g., AlJarrah et al., 2018; Broadbent, 2017; Haghbin et al., 2012; Hong et al., 2021; Klingsieck et al., 2013; Loeffler et al., 2019; Maycock et al., 2018; Yurtseven & Dogan, 2019; Ziegler & Opdenakker, 2018) with notoriously high prevalence reports: at least half of college students procrastinate regularly (e.g., Ferrari et al., 2009; Solomon & Rothblum, 1984). While procrastination is an issue that pre-dates the pandemic, the rapid shift to online learning has been posited to exacerbate its negative effects (Kathleen & Basaria, 2021). Procrastination was measured in the current study using the TPS, which assesses the tendency to delay academic tasks systematically (Tisocco & Fernández Liporace, 2021; Tuckman, 1991).

Regarding academic motivation, a relevant framework facilitating its definition is self-determination theory. It divides motivation in intrinsic, extrinsic and absence of motivation or amotivation. These motivational categories are placed in a continuum with varying levels of self-regulation with increasingly self-regulated behaviours —i.e., intrinsic motivation— associated with more positive academic outcomes than those of least or null self-determination —extrinsic motivation and amotivation (Deci & Ryan, 1991, 2013). *Amotivation* denotes a maladaptive absence of self-determination associated with perceiving a lack of control over events, where students feel incompetent and purposeless. Further, *Extrinsic Motivation* (EM) and *Intrinsic Motivation* (IM) are defined regarding the nature of the academic-related goal —i.e., external or internal. EM refers to engaging in behaviour due to external rewards or pressures, such as grades or approval from others. IM refers to engaging in behaviour because it is inherently enjoyable or satisfying. EM is subdivided into EM external regulation (EM-external), EM introjected regulation (EM-introjected), and EM identified regulation (EM-identified) (Ryan & Deci, 2000). EM-external describes the tendency to perform academic tasks to avoid negative consequences or to receive external rewards, such as studying only to get passing grades or to avoid failing a class. EM-introjected posits the performance of tasks to avoid experiencing guilt, anxiety or to improve self-esteem —the goal comes from within but still involves an external element. In EM-Identified, behaviours come from an internal view of the importance of pursuing external goals, such as appreciating the value placed in higher education by society in general. IM is also subdivided: IM to know (IM-know), IM toward achievement (IM-achievement), and IM toward stimulating experiences (IM-SE). IM-know refers to performing activities to gain knowledge; IM-achievement englobes behaviours conducted to generate products or overcome personal limitations; finally,

IM-SE describes performing activities in pursuit of abstract aesthetic or intellectual purposes (e.g., Deci & Ryan, 2013; Stover et al., 2012; Vallerand et al., 1992). The present study therefore employed the Academic Motivation Scale (AMS) to measure these motivational dimensions among undergraduate students (Stover et al., 2012; Vallerand et al., 1992).

This study aimed to explore procrastination and academic motivation specifically within the context of the COVID-19 pandemic. By examining both pre-pandemic and during-pandemic data, this study seeks to fill the gap in understanding how the pandemic has affected students' procrastination behaviours and academic motivation levels, providing insights into potential interventions needed to support student success in online academic contexts. A central argument in the literature is that the change in the style of education and the transition to online learning would impact students negatively in terms of increased procrastination and decreased academic motivation, with a consequential worsening of academic performance (Haekal et al., 2022; Melgaard & Monir, 2021). It has been argued that, since the students' lives have been shifted majorly, therefore their motivation, procrastination, and quality of both their instruction and work have changed as well (Bao, 2020; Padilla & Pan, 2021). It has also been proposed that procrastination in higher education would be particularly increased due to these changes (Morais Peixoto et al., 2021; Rahimi & Vallerand, 2021), mainly because procrastinatory behaviours are facilitated by online/distance learning settings (Meier et al., 2016; Rasheed et al., 2020). In this vein, and as previously stated, the present study will provide evidence as to whether the pandemic has in fact caused an increase in procrastination levels.

Following, it has been shown that undergraduates with lower self-regulation conduct themselves worse within blended-learning environments (Bao, 2020), and procrastination as a self-regulation deficit has been positively linked to online-learning ineffectiveness amidst the pandemic (Hong et al., 2021). Procrastinators also encountered increased challenges maintaining academic motivation in comparison with non-procrastinators, with a lack of academic motivation also being reported as one of the main difficulties faced by online-learning students (Melgaard et al., 2022; Usher et al., 2021). Moreover, undergraduates with higher fear of COVID-19 reported increased procrastination levels (Doğanülkü et al., 2021).

Despite these claims and reports, little research has been conducted to formally ascertain whether procrastination and academic motivation levels have respectively increased and decreased during the pandemic (Unda-López et al., 2022). In this vein, empirical studies have provided mixed evidence to these latter arguments: on the one hand, a small increase in procrastination was reported by Olga et al. (2021) when comparing procrastination *before* and *during* the pandemic, yet it is not entirely clear whether participants actually completed measures before the pandemic or reflected back on their pre-pandemic selves. Moreover, in that study, only a descriptive approach was employed for the comparison, with no formal statistical hypothesis testing. In another study by Usher et al. (2021), students reported an increase in procrastination and decreased academic motivation when retrospectively compared with pre-pandemic habits, as measured by self-report psychometric instruments. They also referred to an inability to motivate themselves when in online settings while experiencing increased demand to self-regulate without external structure. Puzzlingly, other studies reported a *decrease* in procrastination, as well as stability and increased academic motivation in respectively introverted/extroverted students when compared prior to and during the pandemic, albeit this work was conducted in high-school students (e.g., Padilla & Pan, 2021; Smith et al., 2021).

In summary, some research has demonstrated positive aspects of online-based learning during the pandemic, with others finding this context as having more challenges than academic benefits (c.f., Aucejo et al., 2020; Melgaard et al., 2022; Padilla & Pan, 2021; Smith et al., 2021). The seeming incongruence between the predominantly negative hypotheses and the mixed empirical evidence provides a strong argument for conducting additional research focused specifically on these two key variables. Therefore, there is a need to investigate whether the pandemic has exacerbated procrastinatory behaviours and whether it has affected different types of academic motivation, both intrinsic and extrinsic. Understanding these changes is relevant for developing targeted interventions to support students' academic success during and after such disruptive events, along with integrating these changes as online learning settings are further adopted within higher education. The aim of the current study was, therefore, to examine the relations between procrastination and academic motivation pre and during the pandemic.

Method

Design and data collection

A cross-sectional study design was conducted. The students were recruited via a convenience sampling approach through social media platforms. The recruitment advertisement was designed to target undergraduate students attending public universities in Buenos Aires City and environs. The advertisement was shared with student organizations and groups affiliated with different institutions to increase the chances of reaching a diverse sample. During the screening process, participants were asked to indicate the name of the institution they were attending alongside their sociodemographic and contextual factors. These included age, gender, job status (employed or unemployed), civil status (single or non-single), whether they lived with their family of origin (yes or no), and academic background information such as the number of semesters of studies completed and their subject major.

Participants

Participants were 1486 undergraduates (M_{age} = 26.50, SD_{age} = 8.09; Semesters Studied: M = 8.51, SD = 6.58) attending public universities from Buenos Aires City and environs in Argentina. A subtotal of 905 students participated during the pre-pandemic data collection wave (M_{age} = 26.50, SD_{age} = 8.09; 81.2% female, 18.8% male); 581 students did so during the pandemic (M_{age} = 27.10, SD_{age} = 7.54; 90.4% female, 9.6% male). Data were collected from the city and environs' public college network, consisting of 16 institutions with similar curricula and characteristics. Table 1 details the frequency percentages of participants' demographic variables pre- and during-pandemic.

Table 1

Proportion of participants across sociodemographic and academic variables according to time-point.

	Pre-pandemic	During pandemic
Gender	81.2% Female 18.8% Male	90.4% Female 9.6% Male
Job Status	56.9% Employed 43.1% Unemployed	52.3% Employed 47.7% Unemployed
Civil Status	75.4% Single 24.6% Not-Single	73.2% Single 26.9% Not-Single
Lives with Family of Origin	61.4% Yes 38.6% No	46.5% Yes 53.5% No
Major Branches	42.9% STEM 57.1% Social/Human Sciences	43.1% STEM 56.9% Social/Human Sciences
Pandemic	60.9%	39.1%

Instruments

The following instruments were used (please refer to table 1 for internal consistency estimates of the psychological scales):

Sociodemographic and situational factors. The questionnaire included sociodemographic and situational variables to allow for statistical control of demographic and academic factors at the data analysis stage (refer to Data Analysis section for additional details). Participants provided their age, gender (open ended response, recoded as Male/Female as per answers by participants), job status (employed/unemployed), civil status (single/not-single), whether they lived with their family of origin (yes/no), university name, and academic background information —number of semesters of studies undergone at moment of response, and subject major. Students were classified as studying within one of five major branches per an Argentinian higher education classification —Engineering and Technology, Social Sciences, Medical Sciences, Human Sciences, Math, and Natural Sciences (Argentinian Ministry of Education, 2015). These variables were included as control variables in the analyses to account for potential confounding factors and ensure comparability across groups. The incorporation of sociodemographic and situational factors was performed to achieve statistical matching between groups (Pearce, 2016), enabling a more accurate assessment of the relationships under investigation while reducing bias due to variability in these characteristics.

Tuckman Procrastination Scale (Tisocco & Fernández Liporace, 2021; Tuckman, 1991). This scale measures academic procrastination, described as a "tendency to delay or put off doing things" (Tuckman, 1991, p. 475). It has been widely employed to assess procrastination within higher education research (Kim & Seo, 2015; McCloskey, 2011). The present Argentinian version has exhibited satisfactory validity evidence as well as excellent internal consistency (Furlan et al., 2014; Tisocco & Fernández Liporace, 2021). It consists of 15 items with a 5-point Likert scale,

ranging from *Never* (1) to *Always* (5). Example items include: "I delay starting things until the last minute," and "I needlessly delay finishing jobs, even when they're important".

Academic Motivation Scale (Stover et al., 2012; Vallerand et al., 1992). This 27-item questionnaire lists motives for undergraduates to pursue their studies, and students rate their level of agreement with each motive on a 4-point Likert scale from *Completely Disagree (1)* to *Completely Agree (4)*. It includes seven subscales measuring the academic-motivational dimensions described in the introduction — Amotivation (e.g., "I don't know why I am studying"), EM-external (e.g., "Because I want to have a good life later"), EM-introjected (e.g., "Because I would feel guilty if I didn't study"), EM-identified (e.g., "Because I believe that education will improve my career prospects"), IM-know (e.g., "Because I find it interesting to learn new things"), IM-achievement (e.g., "Because I want to achieve personal goals"), and IM-SE (e.g., "Because I enjoy experiencing new ideas"). The Argentinian version of the scale was employed, which has verified satisfactory validity and reliability evidence (e.g., Stover et al., 2012; Stover et al., 2015).

Procedure

The data collection was structured in two waves. The first wave took place before the pandemic, in January 2020, while the second wave occurred in July 2021, during the pandemic. Participants were recruited via social media platforms and student groups associated with public universities in Buenos Aires City and its environs. The recruitment advertisement targeted undergraduate students and provided information about the study, which aimed to examine psychological variables associated with university life, particularly focusing on academic procrastination and motivation.

Participants accessed an online questionnaire where they provided informed consent by ticking a box. The questionnaire collected sociodemographic information and responses to the Tuckman Procrastination Scale and the Academic Motivation Scale. The confidentiality and anonymity of their responses were assured, and participants were informed that participation was voluntary, with the option to withdraw at any time without consequences. No compensation was offered for participation. This study was conducted with the approval of the home institution's Ethic Committee upon verifying satisfactory compliance with ethical standards.

Data analysis

The primary objective of this study was to investigate the impact of the COVID-19 pandemic on academic procrastination and various dimensions of academic motivation among undergraduate students. Specifically, we aimed to determine whether there were significant differences in procrastination and motivation levels before and during the pandemic. Eight hierarchical multiple-regression analyses were conducted with each of the psychological constructs as dependent variables —namely, Procrastination, IM-SE, IM-Achievement, IM-Know, EM-Identified, EM-Introjected, EM-External, and Amotivation. For each of the models, variables were inputted in two steps. In step 1, the sociodemographic and academic variables were introduced: dummy-coded Gender (0 = Male, 1 = Female), Job Status (0 = Unemployed, 1 = Employed), Civil Status (0 = Not-Single, 1 = Single), Living Status (0 = Living without family of origin, 1 = Living with family of origin), factor-coded Major Branches, Age, and Number of Semesters since started studying. A dichotomous dummy-coded variable labelled *Pandemic* was created, denoting membership to the pre/during-pandemic sample (0 = Pre, 1 = During). This variable was introduced in step 2 to

assess the difference in levels of each psychological construct due to pre-during-pandemic group membership above-and-beyond sample characteristics.

With the present approach being exploratory, another need of the study was to potentially gather evidence of both the presence and *absence* of effects of the pandemic on the psychological variables. Thus, both Frequentist and Bayesian statistical approaches were adopted, implementing the latter to calculate Bayes Factors (BF) of the difference between the models in step 1 —i.e., only sample characteristics— and step 2 —sample characteristics + Pandemic variable. The BF can be considered an inferential tool to quantify relative evidence for competing hypotheses in light of observed data (Gronau et al., 2019). BF values typically lie between 0.01 and 100 (Wetzels et al., 2011) and can be interpreted as akin to an Odds-Ratio value of the *strength of evidence* of competing hypotheses H_0 and H_1 (Quintana & Williams, 2018). Thus, by calculating a BF, a measure quantifying the certainty of the presence or absence of an effect can be extracted in light of observed estimations from the data (Kass & Raftery, 1995). The BF calculation in regression analysis quantifies the strength of evidence between H_0 = *slopes are zero* and H_1 = *slopes are nonzero;* by comparing between two regression models such as the ones formulated in this study, one can compute the BF of those predictors entered above-and-beyond covariates already present (e.g., Etz, 2015; Morey et al., 2021). Thus, by conducting a comparison between those models outlined in step 1 and step 2, the BF would render a quantification of the strength of evidence of the presence or absence of effects of the pre-during-pandemic group membership —i.e., either the regression slopes of the Pandemic variable being zero or nonzero—, controlling for sample characteristics. This procedure would allow assessing presence/absence of effects of the pandemic on procrastination and motivation in both an exploratory and more comprehensive manner than with a Frequentist approach alone. The BF_{01} was calculated because it constitutes a more readily interpretable value of the strength of evidence *in favour of* H_0 (i.e., values higher than 1 indicate *evidence in favour of* H_0 of an effect). A medium-sized (r scale = $\sqrt{2}/4$) prior was employed (Morey et al., 2021). Interpretation of the BF_{01} was carried out according to guidelines typically employed in the literature (Lee & Wagenmakers, 2014); BF_{01} between 1 and 3: *anecdotal* evidence of absence of effects, BF_{01} between 3 and 10: *moderate* evidence, BF_{01} between 10 and 30: *strong* evidence, and so on. Conversely, values of BF_{01} below 1 would indicate strength of evidence of the *presence* of an effect (Kass & Raftery, 1995).

The measures of interest for each of the eight regression models were the model-change parameters (step-1 vs. step-2 R^2-change), BF_{01} values, and, if statistically significant model-change parameters, standardized regression coefficients of the Pandemic variable in the final models.

Finally, if a pre-during-pandemic statistically significant effect were found regarding procrastination, a post-hoc ordinal logistic regression analysis would be conducted with a median-split-categorization of procrastinators as a dependent variable. This latter classification of procrastinators/non-procrastinators involves categorizing students above the procrastination-score median as *procrastinators* and those equal-to or below as *non-procrastinators* and is commonplace in the literature (Ferrari et al., 1995; Fogelmark & Tidman, 2019). This analysis would thus render an Odds-Ratio (OR) estimation of the during-pandemic effect on procrastination above-and-beyond academic-sociodemographic covariates, after which a Relative-Risk rate could be calculated by considering the pre-pandemic procrastination

prevalence rate along with said OR (Zhang & Kai, 1998). This latter metric would provide a concise and meaningful measure (i.e., in percentage values) of *the change in the risk of being classified as a procrastinator after the outbreak of the pandemic relative to pre-pandemic levels*. It would thus aid in contextualizing the effect size of the impact of the pandemic on student procrastination. As stated in prior sections, attention should be placed on the fact that a focus is being placed on psychological variables, excluding other potential sociological factors of interest such as inadequate time, space, and resources to enable continuation of studies – these elements fall beyond the scope of this study.

Results

The main aim of this study was to examine levels of procrastination and academic motivation before and during the Covid-19 pandemic to determine to what extent the move to online learning impacted these variables among undergraduate students? Descriptive information regarding mean levels of procrastination and academic motivation can be seen in Table 2, as well as the reliability estimates for each questionnaire (ordinal-α coefficients; Gadermann et al., 2012). These estimates all indicate that the questionnaires had acceptable to good reliability.

Table 2

Means, standard deviations, and reliability estimates of procrastination and academic motivation variables.

	Pre-Pandemic M (SD)	Min-Max	During-Pandemic M (SD)	Min-Max	α [a]
Procrastination	41.60 (10.56)	15-73	44.23 (11.39)	15-73	.91
IM-SE	11.12 (2.78)	4-16	11.18 (2.69)	4-16	.75
IM-Achievement	12.95 (2.83)	4-16	13.01 (2.77)	4-16	.86
IM-Know	14.06 (2.37)	4-16	14.08 (2.35)	4-16	.90
EM-Identified	12.83 (2.66)	4-16	12.65 (2.57)	4-16	.76
EM-Introjected	8.49 (3.18)	4-16	8.65 (3.16)	4-16	.77
EM-External	8.95 (2.60)	3-12	8.86 (2.58)	3-12	.84
Amotivation	4.80 (1.79)	4-16	4.91 (1.89)	4-16	.93

[a]: *Ordinal-α.*

To assess pre- and during-pandemic differences in procrastination, a hierarchical multiple regression analysis predicting procrastination was carried out (see Table 3). In step 1, sociodemographic and academic variables were entered into the model to control for their effects on procrastination. In step 2, the Pandemic variable was added to determine whether being part of the during-pandemic sample contributed to differences in procrastination levels. The addition

of the Pandemic variable in step 2 was statistically significant (ΔR^2 = .01, $F_{(1, 1474)}$ = 13.57, p < .001, BF_{01} = .008; β = .10, p < .001). Thus, belonging to the during-pandemic sample accounted for a small but significant increase in procrastination relative to pre-pandemic levels above-and-beyond sample characteristics; following the observed BF_{01} value and interpretation guidelines, there is an *extreme* certainty for the presence of this effect (Lee & Wagenmakers, 2014).

Since the statistically significant effect of the pandemic on procrastination was verified, a logistic regression analysis was conducted to further examine the likelihood of students being classified as procrastinators during the pandemic. Students above the procrastination median (*Mdn* = 43) were categorised as procrastinators, and a dichotomous variable (0 = *non-procrastinator*; 1 = *procrastinator*) was employed as dependent variable. The independent variables were identical to the multiple linear regression conducted above to obtain an Odds-Ratio effect size (OR) of the Pandemic variable gauging the relative impact of the pandemic on the odds of being classified as a procrastinator above and beyond sample characteristics. The logistic regression analysis produced an OR of 1.45 for the Pandemic variable (CI_{95} = [1.16, 1.82], *p* < .001), indicating that students during the pandemic were 1.45 times more likely to be classified as procrastinators compared to pre-pandemic students, after controlling for other sample characteristics. This means that the during-pandemic prevalence rate increased by 45% in comparison to the pre-pandemic rate. Following this analysis, the procrastination prevalence rate prior to the pandemic was calculated (42.76%) —this OR was employed jointly with the pre-pandemic prevalence rate to calculate the Relative-Risk coefficient as denoted in Zhang and Kai (1998). Such Relative-Risk was RR = 1.22, CI_{95} = (1.09, 1.35). During the pandemic, therefore, undergraduates were at an estimated 22% increased risk (range 9-to-35%) of becoming procrastinators compared to pre-pandemic students. Model-change parameters and BF_{01} values and their interpretations for all eight predictive models —procrastination and academic motivation variables— are displayed in Table 4.

Regarding academic motivation, seven hierarchical multiple regressions were conducted as with procrastination, each with respective motivational subdimensions as dependent variables —IM-SE, IM-Achievement, IM-Know, EM-Identified, EM-Introjected, EM-External, Amotivation. The Pandemic variable did not account for any statistically significant explained variance in each of the seven models above-and-beyond sample characteristics, with ΔR^2 values of .00 in all cases, p-values ranging from .149 to .891, and BF_{01} values between 2.01 and 5.23.

Table 3

Hierarchical regression analysis predicting procrastination.

	Step 1 (R^2 = 0.05; *F* = 7.24***)			Step 2 (R^2 = 0.06; *F* = 7.87***)		
	B	***SE B***	**β**	***B***	***SE B***	**β**
Intercept	46.09	1.93		45.12	1.94	
Age	-0.22	0.05	-.16***	-0.21	0.05	-.15***
Gender (1 = Female)	0.01	0.83	.00	-0.28	0.83	-.01
Job status (1 = Employed)	-0.33	0.59	-.02	-0.38	0.59	-.02
Civil Status (1 = Single)	0.66	0.88	.03	0.57	0.88	.02
Living Status (1 = Living with family of origin)	-0.61	0.80	-.03	-0.41	0.80	-.02
No. of Semesters of Studies	0.24	0.05	.15***	0.21	0.05	.13***
Major Branches [a]:						
Technology and Engineering	-0.65	0.97	-.06	-0.18	0.97	-.02
Social Sciences	-0.03	0.79	.00	0.38	0.79	.04
Human Sciences	3.23	1.13	.29**	3.36	1.13	.31**
Math and Natural Sciences	3.00	1.45	.27*	3.62	1.46	.33*
Pre-During Pandemic (1 = during)				2.19	0.59	.10***

*Note: * p < .05; ** p < .01; *** p < .001.*
[a] = Reference level: Medical Sciences.

To examine whether academic motivation influenced procrastination differently before and during the pandemic, interaction effects between the seven motivational subscales and the Pandemic variable were tested within the regression model predicting procrastination. However, no statistically significant interactions were found ($p > .05$), meaning that the relationship between motivation and procrastination remained stable across both time periods. In other words, the extent to which motivation predicted procrastination did not change due to the pandemic, suggesting that any observed increase in procrastination was independent of students' academic motivation levels.

Table 4

Model-change parameters of pandemic variable in each regression analysis, BF_{01} values, and respective interpretations of the pandemic effect.

Model No.	Dependent Variable	Addition of Pandemic variable model-change values	BF_{01}	Interpretation of BF_{01}[a]
1	Procrastination	ΔR^2 = .01, $F_{(1, 1474)}$ = 13.57, p < .001	0.01	*Extreme* evidence of *presence* of pre-during pandemic effect on dependent variable
2	IM-SE	ΔR^2 = .00, $F_{(1, 1474)}$ = 0.08, p = .781	5.10	*Moderate* evidence of *absence* of pre-during pandemic effect on dependent variable
3	IM-Achievement	ΔR^2 = .00, $F_{(1, 1474)}$ = 0.02, p = .891	5.23	*Moderate* evidence of *absence* of pre-during pandemic effect on dependent variable
4	IM-Know	ΔR^2 = .00, $F_{(1, 1474)}$ = 0.17, p = .680	4.59	*Moderate* evidence of *absence* of pre-during pandemic effect on dependent variable
5	EM-Identified	ΔR^2 = .00, $F_{(1, 1474)}$ = 2.09, p = .149	2.04	*Anecdotal* evidence of *absence* of pre-during pandemic effect on dependent variable
6	EM-Introjected	ΔR^2 = .00, $F_{(1, 1474)}$ = 1.99, p = .158	2.01	*Anecdotal* evidence of *absence* of pre-during pandemic effect on dependent variable
7	EM-External	ΔR^2 = .00, $F_{(1, 1474)}$ = 0.05, p = .818	5.16	*Moderate* evidence of *absence* of pre-during pandemic effect on dependent variable
8	Amotivation	ΔR^2 = .00, $F_{(1, 1474)}$ = 0.62, p = .431	3.48	*Moderate* evidence of *absence* of pre-during pandemic effect on dependent variable

Addition of Pandemic variable model-change values: difference in variance explained due to entering the pre-during pandemic variable, controlling for sociodemographic and academic variables.
BF_{01}: BF_{01}-value associated with entering the pre-during-pandemic variable, controlling for sociodemographic and academic variables.
[a]: Lee & Wagenmakers (2014).

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Discussion

The study sought to provide an initial assessment of the effect of the pandemic on relevant higher education psychological variables including procrastination and multiple dimensions of academic motivation.

Procrastination

A statistically significant but small pre-during pandemic difference was found regarding procrastination levels. The strength of evidence of this effect's presence was *extreme* (Lee & Wagenmakers, 2014). Undergraduates were estimated to be 22% more likely to become procrastinators after the advent of the pandemic. This finding aligns with most literature claims regarding the transition to online-based settings as a potential facilitator of procrastinatory behaviours (e.g., Rahimi & Vallerand, 2021; Morais Peixoto et al., 2021). Notably, it also contradicts reports of reduction of procrastination within high-school settings (e.g., Padilla & Pan, 2021). Regarding the latter aspect, it could be hypothesized that the transition to online-based learning within an environment characterized by the need for more self-regulation —such as higher education— provides more opportunities for students to fall into increased procrastinatory behaviours, and the college-level pandemic effect could be opposite to that observed in high-school settings. This last point is a common distinction in procrastination literature, where procrastination is posited to intensify after transitioning from high school to college (e.g., Krause & Freund, 2014). This finding of an increase in procrastination and its contextualization in terms of an increased relative-risk may serve as epidemiological information to guide interventions and may aid in understanding the pandemic's impact on higher education students. However, consideration must be placed to the low R^2-value detected within the regression analysis (R^2 = 0.06 in the final model). This suggests that other factors not accounted for in the model—such as self-regulation skills, mental health conditions, or access to structured learning environments—may play a role in procrastination beyond sociodemographic characteristics and the pandemic itself. Moreover, a multiple linear regression framework was adopted within the study because of its clarity and ease of use, as well as the possibility to employ calculation of the BF coefficients in a straightforward manner. Recent literature suggestions support this decision, in favour of opting for multiple linear regressions over multivariate group-difference tests such as MANOVA or MANCOVA (Huang, 2020). This decision notwithstanding, future studies could adopt analysis-of-variance statistical approaches to analyse group differences, and thus provide an ampler array of analyses from which to study the relationships between psycho-educational variables and the pandemic phenomenon in higher education.

Academic Motivation

An overall absence of the effect of the pandemic on all the motivational variables was observed. Certainty for the absence of effects was stronger for all IM dimensions (IM-SE, IM-Achievement, IM-Know), as well as EM-External, and Amotivation. Conversely, a weaker certainty of the absence of pandemic effects was observed regarding EM-Identified and EM-Introjected. Thus, findings suggest that academic motivation levels remained stable during the pandemic compared with before the pandemic, similar to findings in high-school students (Smith et al., 2021). In this sense, the absence of change in the students' motivation provides valuable information: in light of the present results, appealing to interventions that rely more on IM dimensions rather than EM

may account for more robust results due to the *moderate* certainty of the absence of the pandemic effect on IM, as opposed to the *anecdotal* certainty of the EM-Identified and EM-Introjected dimensions. Thus, interventions reported previously in the literature might turn increasingly relevant for their success in boosting performance, such as improving perceptions of the relevance of undergraduates' studies to their lives (i.e., IM; Harackiewicz et al., 2016; Hulleman et al., 2007; Hulleman et al., 2010), and enhancing students' perception of autonomous choice over in-class tasks (Vansteenkiste et al., 2004). Additional research is needed regarding these two latter variables to ascertain the impact of the pandemic.

Further, the *moderate* certainty of the absence of a pandemic effect on Amotivation could be interpreted as of a positive nature. This maladaptive motivational pattern has not shown differences before and after the transition to online-based settings. As with the case of procrastination, these findings are considered to aid epidemiological analyses of these constructs and provide more insight into the abrupt transition to online-based settings within higher education.

Finally, no significant interactions between motivation and the pandemic were observed in the prediction of procrastination, denoting the possibility that the pandemic affected student procrastination regardless of their motivation levels. Thus, while motivation might still play a role in affecting procrastination (Tisocco & Fernández Liporace, 2023), the advent of the pandemic has not changed this relationship in our data. This latter aspect could be considered as further evidence in favour of capitalising student motivation to address procrastination both preventively and remedially.

Limitations

Limitations of the present study mainly involve combining a cross-sectional and convenience sampling design. Efforts were made to control for effects of sample-characteristics covariates (Pearce, 2016), in a similar vein as with other studies (e.g., Rutherford et al., 2021). However, caution about the interpretation of the findings is advised — particularly so when a more robust design would have stemmed from a longitudinal within-subjects study.

Further, the contextualization of the procrastination findings in terms of relative risk involved a *median-split* dichotomization of the variable (i.e., *non-procrastinators* / *procrastinators*). While a commonly-applied procedure in the literature, reports have expressed concerns —it has been argued that it constitutes an arbitrary division, and entails loss of information and statistical power (Chowdhury & Pychyl, 2018). This element is an additional study limitation that must be considered while interpreting results. However, the relative-risk information resulting from having employed this dichotomized variable is believed as complementary to the linear regression analysis, aiding in interpreting the finding in more practical terms as opposed to a standardized or effect-size label. Moreover, it could also be stated that the loss of information did not compromise the validity of the results when considering the *extreme* certainty found for the presence of the effect —i.e., the BF_{01} value. As noted in the introduction, however, the fact remains that the present study mainly focused on specific psychological factors that have been documented as relevant to higher education student performance. Aspects inherent to more contextual variables, such as lack of study time and inadequate resources to continue pursuing an education fall outside of the scope of the present study. On a similar note, other health-related factors were at play during the pandemic that could have impacted results, such as overall mental

health, psychological distress, and physical health. Lastly, attention should be placed on the fact that this work examined the impact of the pandemic in Argentina, where lockdowns and curfews were put in place that drove education to online settings between March 2020 and a substantial portion of 2021 – this also exacerbated prior economic instability within the country. Findings from studies conducted in other countries might vary due to differences in national lockdown, economic, and educational policies implemented.

Recommendations for Future Research

An interesting question would be to assess whether the rise in procrastination during the pandemic effectively leads to poorer academic outcomes, which constitutes another aspect relevant to the current literature on the pandemic's impact in higher education (e.g., Mahdy et al., 2021; Pelikan et al., 2021). However, this could prove challenging due to the educational grading system potentially changing during the pandemic, as stated in the Introduction section (Melgaard & Monir, 2021; Padilla & Pan, 2021); this latter uncertainty is further exacerbated by the fact that during-pandemic learning has become more heterogenous in the sense that institutions have now adopted varying ratios of virtual to face-to-face education. Additional work will have to be undergone to further characterize during-pandemic –albeit now post-pandemic– learning within higher education, along with the continuing study of procrastination levels. In this vein, research employing various ways to assess academic performance may prove fruitful in carrying out these analyses and help provide depth to the study of to what extent psycho-educational variables impact achievement among higher education students.

Conclusion

The main finding was the increase of procrastination due to the advent of the pandemic. The transition to online learning during COVID-19 seems to have driven students to procrastinate more at that time, yet their academic motivation levels remained stable. Considering that motivation may be viewed as a predictor of procrastination (Tisocco & Fernández Liporace, 2023), interventions striving to limit procrastination could aim to enhance or capitalize on academic motivation. Specifically, through the lens of self-determination theory, interventions addressing intrinsic motivation (Vansteenkiste et al., 2004) could prove fruitful in reducing procrastination or halting its increase. Understanding the shift in procrastination in a pandemic world may provide grounds for future curriculum design that enhances choice-perception within classrooms (Vansteenkiste et al., 2004) to ensure procrastination levels do not increase within online or blended-learning contexts.

In sum, the present study highlights the importance of considering the impact of external factors, such as a global pandemic, on student procrastination, and the potential of considering academic motivation as an aid or target for interventions aimed at limiting the rise of procrastination.

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