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Gender Performance in Online University Education

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Abstract

This paper examines the impact of the exogenous shock of COVID-19 which led to a transition from in-person to online education, on the academic performance of university students, with a particular focus on gender differences. We exploit a unique and comprehensive dataset that includes all evaluation activities and their outcomes, for students enrolled in 2018 and 2019 at the main university in Uruguay. Using difference-in-differences techniques, we find that female students outperformed their male counterparts by passing more courses and improving their grade point average. This effect is observed among women from higher socioeconomic backgrounds and those who enter university immediately after finishing secondary school. Exploring the mechanisms behind these outcomes, we find that women report having greater participation compared to in-person classes, perceive more advantages in staying at home, and recognize more benefits in not commuting to the educational institution.

Keywords: Gender, education, performance, online learning, university

JEL Classification: J13, J16, I24

1. Introduction

Online education gained significant and unprecedented prominence during the COVID-19 pandemic. Following the transition back to in-person classes, the adoption of distance education continued to grow, with online components increasingly integrated into traditional face-to-face courses.

During the COVID-19 pandemic and its aftermath, there was a rapid expansion in the literature examining how online education exacerbated the educational gap across socioeconomic groups (Andrew et al. (2020), Rodriguez-Planas (2022), Chetty et al. (2024)). Limited access to computers, unreliable internet connectivity, and digital disparities among families were identified as key mechanisms contributing to this gap. Moreover, online education demands higher levels of discipline and time management, which can further challenge students from disadvantaged backgrounds (Cunha and Heckman (2007)).

Several studies have also examined the impact of online education on mental well-being (Browning et al. (2021)), student performance (Rodríguez-Planas (2022), Rodriguez-Planas (2022)), career and earnings expectations (Aucejo et al. (2020), Jaeger et al. (2021)), and evaluations of the college experience (Aucejo et al. (2023)). Additionally, a body of research has analyzed how teachers' performance varied in online settings and how these changes influenced their evaluations. For example, Ayllón (2022) finds that female teachers received lower evaluations compared to their male counterparts.

Finally, Failache et al. (2025) focusing on first-year university students in Uruguay, finds that students enrolled in 2020 are more likely to drop out, but also to obtain better grades than previous generations. The effects are more pronounced among boys and students from more disadvantaged socioeconomic backgrounds. In this article, using data from the academic trajectory of the students from the biggest Uruguayan university, we analyze whether online education affects men and women differently. We have an outstanding database containing the performance records of students from the Universidad de la República (Udelar), which accounts for more than 85% of university students in Uruguay.[1] Our analysis focuses on students who enrolled in the university in 2018 or 2019 across different faculties, ensuring representation from different academic fields. For these students, we have comprehensive data on all their evaluations and outcomes through

[1] According to the Statistical Yearbook of the Ministry of Education of Uruguay, in 2018, students enrolled at UDELAR numbered 139,877, while the total number of university students was 161,585. In 2021, students at the public university (Udelar) increased to 156,437, and the total number of university students reached 181,842.

the end of 2021, allowing us to track their academic trajectories both before and after the shift to online education.

We find that women tend to perform better than men in online education, as evidenced by higher pass rates and improvements in their grade point averages. To assess the robustness of these findings, we conduct several heterogeneity and sensitivity analyses, which confirm consistent results across the three faculties analyzed—social sciences, STEM, and biological sciences. Further analysis shows that the performance advantage among women is particularly pronounced among higher-income students and those who enter university immediately after finishing secondary school. We also explore potential mechanisms behind these outcomes, focusing on three key factors. First, we assess gender differences in satisfaction with online education. Second, we examine the role of concentration, considering that online learning requires greater focus and self-discipline. Psychological research suggests that women generally outperform men in task organization and sustained attention (Podila (2019)). Third, we analyze the impact of class gender composition, noting that online environments may reduce the potentially discouraging presence of male peers. Prior studies have shown that women often achieve better outcomes in settings where direct competition with men is less salient (e.g., Gomez-Ruiz et al. (2024); Jackson (2012)).

A closely related study is that of Erdemli and Vall Castelló (2024), which examines gender differences in online education among school-aged children. While it also investigates performance gaps between boys and girls, the younger age group places significant emphasis on parental involvement and the time parents devote to their children's learning. Their findings indicate that online education tends to benefit boys. In contrast, our study focuses on university students, where parental academic support is largely absent. We find the opposite result: women perform better in the online setting. This suggests that, in our context, performance differences are driven primarily by individual factors rather than external support.

Our paper contributes to various branches of the literature. First, it contributes to the literature analyzing the impact of COVID-19 and online education on different outcomes (such as the papers on Browning et al. (2021), Andrew et al. (2020), Rodríguez-Planas (2022), Chetty et al. (2024) and Ayllón (2022)) Second, it contributes to the literature examining the performance of men and women within the educational system (Carlana (2019), Lavy and Sand (2018), Barrios-Fernández and Riudavets-Barcons (2024)).

The structure of the article is as follows: Section 2 provides the institutional background

of the educational system in Uruguay. Section 3 describes the data used in the analysis, while Section 4 outlines the empirical strategy. Section 5 presents the main results, the robustness checks, and the heterogeneity analyses. Section 6 explores different mechanisms that explain our results, and finally, Section 7 concludes the study.

2. Institutional Background

In Uruguay, education is compulsory for 14 years, from ages 4/5 to 17/18. The educational system is divided into four levels: Pre-school (ages 3–5), Primary (ages 6–11), Secondary (ages 12–17), and Tertiary (ages 18+). Secondary education can be pursued in two different paths: general or vocational. In addition, it is further divided into two stages: lower secondary education (ages 12–14) and upper secondary education (ages 15–17). Education is universally accessible and free of charge, spanning the entire continuum from pre-school to university. The public education system is overseen by the National Administration of Public Education (ANEP), except for tertiary education, which is managed by the University of the Republic (Universidad de la República, Udelar). Additionally, non-formal education programs are available, targeting early childhood (ages 0–2) and young adults, thereby broadening the educational landscape.

In recent years, the number and reach of private institutions offering higher education in Uruguay have expanded. Nonetheless, tertiary education remains largely concentrated at Udelar, the first of two public universities and the country's leading institution. According to data from the Ministry of Education of Uruguay, in 2023, Udelar accounted for 86% of total university enrollments and offered the most diverse range of academic disciplines.

Uruguay has been a pioneer in the field of education, particularly through the implementation of the *One Laptop Per Child* initiative, led by Ceibal, a public-private agency that ensures connectivity and access to educational content for primary and secondary students in the public system. Despite these advancements, Uruguay still faces substantial educational challenges, particularly regarding secondary school completion and tertiary graduation rates. Recent research highlights that Uruguay has the lowest tertiary graduation rates in the region, with only 0.9% of students aged 20 to 24 completing their tertiary education, compared to 10.2% in Chile (MEC, 2021). The root of this issue lies in secondary education, where only 57% of students graduate within the expected time frame. Furthermore, recent data from the 2020–2021 period indicates a dropout rate of approximately 24% during the fourth and fifth years of high school (ANEP, 2021).

The challenges in tertiary education, particularly the low graduation rates, pose significant obstacles to the effectiveness of Uruguay's higher education system. Despite being tuition-free, many students face financial pressures that compel them to balance academic responsibilities with employment, often resulting in prolonged study periods or dropping out altogether. This issue is exacerbated by inadequate academic preparation from secondary education and the lack of support services, such as mentoring programs or flexible study options for working students. These barriers hinder retention and the timely completion of university degrees, which are essential for equipping the workforce with the skills needed to drive innovation and economic growth. To address these challenges, it is crucial to implement policies that support working students, including more flexible course scheduling, enhanced academic advising, and expanded financial assistance to cover living expenses. Such measures would improve both retention and graduation rates in tertiary education.

University education in Uruguay has traditionally been conducted in person. The new curricula usually organize courses into theoretical/practical classes, without attendance control but encouraging it. The first COVID-19 case in Uruguay was detected on March 13, 2020, right as university courses were beginning. The pandemic brought a substantial shift, as all faculties transitioned to online classes during 2020 and 2021. The learning process at Udelar utilized both previously developed tools and new ones. Prior to COVID-19, Udelar had a virtual platform (Entorno Virtual de Aprendizaje, EVA) that was used alongside in-person classes, though its usage varied significantly across faculties. During the pandemic, the use of EVA was expanded, and additional platforms such as Zoom and Teams were also adopted for online teaching.

3. Data

For this study, we utilized three distinct databases from Udelar that can be linked at the individual level. The first is a unique dataset comprising the complete academic records of all students across various fields at Udelar (Health, Social and Arts, and Technology, Natural and Environment Sciences) for all the years covered in the analysis. The second includes individual demographic and personal characteristics for all students. Lastly, the third is a survey conducted among students from Udelar during the pandemic, providing data on how it impacted their experiences and academic performance.

From the first database, we selected students who enrolled at the university in 2018 and

2019 from the Faculties of Economics and Business, Engineering, and Nursing. This selection covers a diverse range of fields—social sciences, STEM, and biological sciences—as well as programs with varying gender compositions. These students were tracked through the end of 2021, enabling an analysis of their academic performance before (2018–2019) and after (2020–2021) the onset of the COVID-19 pandemic, during which online teaching was implemented. It is important to note that in Uruguay—located in the Southern Hemisphere, where summer vacations occur in January and February—academic courses run from March to December. As a result, each academic year aligns exactly with the calendar year. The dataset provides detailed information on students' course enrollments and outcomes. Specifically, it includes records of the courses taken, whether each course was passed or failed, and the grades obtained. Furthermore, for each faculty, we have data on the full student body and can identify the degree or bachelor's program each student is pursuing.

Secondly, we link the previous records with a dataset containing personal characteristics such as age, gender, parental education, when they completed their secondary education, and other relevant information, including scholarship status and employment status. This dataset allows us perform various heterogeneity analyses.

Table 1 presents the structure of our dataset. As shown, it is a panel of students from the three aforementioned faculties who enrolled in the university in 2018 and 2019, and were tracked through to 2021. In total, we have data on 3,802 students, of whom 1,919 enrolled in 2018 and 1,883 in 2019. The attrition observed in subsequent years is due to students either dropping out of the university or switching programs. In total, we have 13,031 student-academic year observations.

Table 2 presents descriptive statistics for the students in our final sample. As shown, we include 3,802 students who enrolled in 2018 and 2019. The proportion of female students in 2018 is slightly higher than that of 2019, and the opposite is true for male students. Regarding fields of study, the majority of students are enrolled in Economics and Business, reflecting the broader enrollment patterns in Uruguay, where this faculty has significantly more students than others. Female students tend to be slightly older at university entry, are more likely to be employed, receive scholarships at higher rates, and are more often parents compared to their male counterparts. In terms of parental education, women are more likely to come from families where parents have lower levels of educational attainment. Therefore, female students in our sample are more frequently from lower socioeconomic backgrounds.

Table 1: **Panel composition**

	1st year	2nd year	3rd year	4th year	Students*Year
2018 cohort	2018	2019	2020	2021	
Men	1008	991	976	908	3383
Women	911	886	886	816	3499
2019 cohort	2019	2020	2021		
Men	1083	1083	1083		3249
Women	800	800	800		2400
Students*Year	3802	3760	3745	1724	13031

NOTE: This table presents the panel composition of the 2018 and 2019 cohorts in our sample. Columns represents the different academic years.

Table 2: **Descriptive statistics. Differences by Gender**

Characteristics	(1) Men	(2) Women	(3) Difference (2)-(1)
Age at university entry	18,418	18,735	0.316*** (0.060)
Working at university entry	0,096	0,147	0.051*** (0.011)
Scholarship	0,046	0,075	0.029*** (0.008)
Having children	0,003	0,016	0.013*** (0.003)
Highly educated parents	0,304	0,340	0.036*** (0.015)
Medium educ. parents	0,463	0,294	-0.169*** (0.016)
Low educ. parents	0,214	0,358	0.144*** (0.014)
Economics and Business	0,537	0,711	0.174*** (0.016)
Engineering	0,436	0,174	-0.262*** (0.015)
Nursing	0,027	0,115	0.087*** (0.008)
2018 cohort	0,482	0,532	0.050*** (0.016)
Students	2091	1711	3802

NOTE: This table presents the descriptive statistics for all first-time students at Udelar, from the 2018 and 2019 cohorts across the three previously mentioned faculties.

Finally, we rely on a survey that provides information on students' perceptions and experiences regarding online education., which will allow us to test mechanisms that explain our main results. In particular, we explore two possible mechanisms. First, the role of concentration and organization when approaching studies, especially among childless women and men. Second, we examine the role of class composition, as in online classes, it is less evident who the classmates they have.

4. Empirical Strategy

We follow two different identification strategies. First, given that we have a panel and can track the same individuals at different points in time, we estimate the following fixed-effects model:

$$Y_{it} = \beta_0 + \beta_1 Women + \beta_2 Online + \beta_3 Women * Online + \beta_4 \mu_i + \epsilon_{it} \quad (1)$$

where Y_{it} denotes one of our different performance indicators such as the number of courses passed for individual i in year y, or the average grades for individual i in year t. The variable $Women$ is a binary variable that takes value 1 if the individual is a women and 0 if it is a men. The variable $Online$ is a dummy variable that takes value 1 if the academic year is 2020 or 2021 during which the pandemic was present and university education transitioned to an online format. Our parameter of interest is β_3, which measures the change in the academic performance of women during online education period relative to men and capture the differential post-pandemic effect on the outcome for a women compare to a men. Finally μ represents the fixed effect of individual i and ϵ_{it} denotes the i.i.d. error term.

Second, we estimate the following difference-in-difference model to estimate the effect of online education on gender performance controlling for characteristics:

$$Y_{it} = \beta_0 + \beta_1 Women + \beta_2 Online + \beta_3 Women * Online + \beta_4 X_{it} + \epsilon_{it} \quad (2)$$

Where all the variables are the same as in the previous regression but we include control variables, denoted by X_{it}, as age, education of the parents, whether the individual has children, employment status, scholarship status, and the degree program they are pursuing.

Furthermore we run several robustness checks and heterogeneous analysis. Firstly, we

compare the results of students who were in their second year of study before online education with those who were in second grade after online education, to eliminate the effect that different courses can have different difficuly. To do this, we compare those who entered in 2018 and thus completed their second year in 2019 (before COVID-19) with those who entered in 2019 and completed their second year in 2020 (after COVID-19).

Secondly, as a placebo analysis, we conduct two exercises. First, we compare those who entered at the University in 2018 and completed their first year that same year with those who entered in 2019 and completed their first course that year. Therefore, we are comparing students who completed their first year in two pre-COVID years to see if we can identify any effects. Second, we compare the results of students who entered in 2018 but analyze their outcomes in their third course, specifically in 2020, with those who entered in 2019 and completed their third course in 2021. In this second case, we are comparing two years during COVID-19, so we should not expect to find a differential effect.

Thirdly, we conduct various heterogeneous analyses. First, we compare the outcomes of students who have children to those who do not have children. The underlying hypothesis is that the effect may differ in the presence of children, as they make hard online education and the effect can be different for women. Second, we compare the results of students whose parents have a university degree with those whose parents do not, with the aim of examining different socioeconomic levels. Third, also to capture a differential effect based on income, we compare students who receive scholarships with those who do not. Fourth, we compare the outcomes of students who enter university immediately after completing secondary education, at ages 17 or 18, with those who enter later, in order to capture the differences between higher and lower-performing students. Finally, we conduct a heterogeneity analysis comparing students born in Montevideo (the capital) with those born in other parts of Uruguay.

5. Results

5.1 Main Results

Women improve their performance in online education compared to men. As shown in Table 3, this improvement is consistent across the different performance indicators. In this table, we present the results of estimating Equations 1 and 2 for all students who enrolled at the university in 2018 and 2019 across the three faculties considered. Here, we focus

on the most important coefficients. The "Online" coefficient represents the differential effect on performance during the COVID-19 years when education was online. Specifically, it captures the effect on men during the online period. The key coefficient, "Women Online" captures the interaction between being female and the online years (2020 and 2021), reflecting the differential effect on women during the period when education was conducted online compared to prior years.

As shown in Table 3, when education is delivered online, women pass more courses and improve their average academic performance, as reflected by an increase in their Grade Point Average (GPA). Since the dependent variables are expressed in standard deviations, we can interpret these results as follows: under online education, women pass 0.11 standard deviations more courses and increase their GPA by 0.14 standard deviation points. Taking into account the pre-online education mean and standard deviation, this implies an increase of approximately 7.3% in the number of courses passed by women compared to men and relative to the pre-online mean and an increase of 7.6% in the average GPA.[2]

In Section 6, we explore various mechanisms that may underlie this result. These include the possibility that women are better able to concentrate, are more effective at organizing their studies while working from home, or that reduced interaction with men leads to improved academic performance.

5.2 Robustness check

5.2.1. Students from the same academic year

As a first robustness check, we compare students enrolled in the same academic year before and after the transition to online education. Specifically, we analyze students who began their studies in 2018 and completed their second year in 2019 (pre-COVID), and compare them with students who started in 2019 and completed their second year in 2020, after the onset of the pandemic and, consequently, under an online education format. This approach allows us to control for potential differences and challenges associated with different academic cohorts. In particular, we compare students' performance in their second year of study before and after COVID-19, under the assumption that this captures the same level of difficulty and academic engagement.

The results in Appendix Table A.1 show that the outcomes are virtually identical to those observed when considering all students who enrolled in 2018 and 2019. The relevant co-

[2]These percentage are calculated as 0.1066*3.39/4.93=0.073 and 0.139*2.67/4.90=0.076

Table 3: **Academic performance of Women in online education**

	Passed courses		Grade Point Average	
	(1) FE	(2) OLS	(3) FE	(4) OLS
Online	0.236***	0.204***	0.104***	0.042
	(0.026)	(0.027)	(0.024)	(0.026)
Women Online	0.107***	0.108***	0.139***	0.157***
	(0.028)	(0.029)	(0.025)	(0.026)
Pre-mean	4.93		4.90	
Pre-SD	3.40		2.67	
Observations	12,774	12,761	12,762	12,750
Students	3,802		3,802	
R^2	0.017	0.079	0,052	0.051

NOTE: This table presents estimates of the effects of online education on women, based on a difference-in-differences strategy. We report the effects using two outcomes: the number of courses passed and Grade Point Average (GPA). Columns 1 and 3 show estimates with individual fixed effects, while Columns 2 and 4 incorporate control variables such as age, parental education, whether the individual has children, employment status, scholarship status, and the degree program being pursued, and are estimated using OLS. "Pre-mean" and "Pre-SD" report the mean and standard deviation of each variable prior to the implementation of online education (i.e., during the years 2018 and 2019). Standard errors are clustered at student level. ***, **, * indicate significance at the 1, 5 and 10% level, respectively.

efficients remain significant and point in the same direction as before. Even within this restricted sample, women perform better than men in the online education setting.

5.2.2. Placebo Test

We conducted two placebo exercises. First, we compared students who entered university in 2018 with those who entered in 2019, both during their first year of university when education was delivered in-person in both cases. Second, we compared students who entered university in 2018, focusing on their performance in their third year (i.e., in 2020), with those who entered in 2019 and completed their third year in 2021. In this case, we are comparing two cohorts experiencing two years of online education. In both cases, we constructed a fictitious year of online education: 2019 in the first exercise and 2021 in the second. The aim is to analyze whether women exhibit different performance during that particular year, despite no actual changes having taken place.

Table A.2 in the Appendix consists of two panels. The first panel, Placebo 1, compares two years of in-person education, while Placebo 2 compares two years of online education. The coefficients for "Woman online," where "online" refers to 2019 in Placebo 1 or 2021 in Placebo 2, are not statistically significant, indicating that no differential effect for women is observed in either case. Therefore, our placebo exercises provide robustness to our identification strategy.

5.3 Heterogeneous analysis

5.3.1. Different studies

In this subsection, we examine whether the improvement in women's performance in online education is consistent across all degree programs or more pronounced in specific fields. To address this, we estimate the regression separately for each of the three faculties.

Table A.3 in the Appendix presents the results for the three faculties, estimated using fixed effects. As shown, all coefficients for the variable "Passed courses" are positive and statistically significant. This suggests that, during the pandemic, women completed more courses than men relative to their performance prior to the transition to online education. When considering average academic performance, the coefficients are positive across all faculties, although not statistically significant in every case. The effect is particularly strong in Engineering, where women not only completed more courses but also improved

their average performance relative to men compared to the pre–online education period. By contrast, in Economics and Nursing, the coefficients are positive but not statistically significant.

Overall, although some coefficients lose statistical significance when disaggregated by faculty, women's performance in online education improved across all fields, spanning the social sciences as well as the scientific and biological disciplines. These results suggest that the shift to online education benefited female students regardless of their area of study.

5.3.2. Parental education

In this subsection, we explore whether the results change when we consider students whose parents have a high level of education compared to those whose parents have a medium or a lower level of education. Parents' higher level of education can be considered an indicator of greater family income and, consequently, a marker of socioeconomic background.

In our classification, parents with a high educational level are defined as those who have attained tertiary education, including undergraduate and postgraduate degrees (master's or doctoral qualifications). Parents with a medium educational level are those who completed upper secondary education and enrolled in tertiary education but did not obtain a degree. Finally, parents with a low educational level are defined as those with less than complete secondary education.

The results of this heterogeneity analysis are presented in Table A.4 in the Appendix. As observed, the most pronounced positive effects of online education for female students occur among those whose parents have medium or tertiary education, and therefore are likely to have higher household socio-economic status. This pattern is consistent for both the number of courses completed and average academic performance. In contrast, the estimated coefficients for students with parents who have less than secondary education are not statistically significant, suggesting limited differential gains for female students in this group.

5.3.3. Having scholarship

In this subsection, we analyze whether the results are similar for students with and without scholarships. Having a scholarship can also be considered an indicator of socioeconomic

status since students who receive scholarships generally come from more vulnerable families. A scholarship reflects the family's current financial situation more accurately than the indicator used in the previous subsection. This is because scholarships are granted based on the family's present income, whereas parental education may or may not be correlated with current income levels.

In Table A.5 in the Appendix, we observe that the best performance in online education is achieved by women who do not have a scholarship and, therefore, do not belong to the most vulnerable families. Upon analyzing the table, we find that the relevant coefficients for women with scholarships are not statistically significant, while for students without scholarships, all coefficients are significant.

These results can guide us in exploring potential mechanisms that we will explore in the next section, as the improved performance is observed among women with greater economic resources.

5.3.4. Lag between secondary education and higher education

Finally, we analyze whether the observed effects differ between students who enter university immediately after completing upper secondary education and those who delay entry due to factors such as lower academic achievement, the need to work, or lower motivation. Specifically, we divide our sample between students whose interval between completing secondary education and entering university is greater than three years and those whose interval is less than three years.

The results, reported in Table A.6 of the Appendix, show that the positive effects of online education for women are concentrated among students who enroll in tertiary education within three years of completing secondary school. These findings highlight heterogeneous effects based on the timing of university enrollment.

6. Mechanism

In this section, we aim to understand the reasons why women achieve better performance indicators in university education when learning is conducted online. This contrasts with findings in the literature regarding workplace performance, where gender disparities often show the opposite trend. However, it is important to highlight that one of the primary

causes of lower performance outcomes in the workplace for women is the presence of children, with mothers typically assuming a greater share of caregiving responsibilities compared to fathers. However, the women in our sample are relatively young—around 20 years old—and most are childless. Why, then, do women in this group perform better?

Table 4: **Online Education Satisfaction by Gender**

Variable	Total	Women	Men	P-value
Satisfaction				
Dissatisfied or very diss. with online educ.	0.197	0,186	0,216	0,225
Indifferent to online education	0,266	0,264	0,27	0,837
Satisfied or very satisfied with online educ.	0,537	0,55	0,515	0,25
Challenges				
Emotional affect	0,702	0,732	0,650	0.004***
Lack of adequate IT resources	0,341	0,362	0,304	0.049***
Connectivity problems	0,135	0,158	0,096	0.003***
Strengths				
Asynchronous clases	0,823	0,818	8,831	0,599
Greater participation	0,359	0,383	0,319	0.031**
Staying at home	0,731	0,768	0,667	0.000***
No need to commute	0,843	0,862	0,809	0.019**
Increased collaboration with other students	0,409	0,427	0,377	0,102
Greater self-assessment opportunities	0,589	0,606	0,559	0,121
Observations	1,304	821	483	

We use survey data collected from students during the COVID-19 period to analyze the differences between male and female students regarding their satisfaction, as well as the advantages and challenges they perceive in online education. Specifically, we work with a survey conducted by the General Directorate of Planning at UDELAR, applied to a sample of 1,305 students in 2020 and 1,891 students in 2021.[3] The purpose of the surveys

[3]For this study, a self-administered web survey was designed and directed at a probabilistic sample

was to evaluate the educational experience in the virtual modality to generate useful input for the design and evaluation of university policies.

In Table 4, we present the main results of the comparison of means between men and women regarding the different questions asked in the survey in 2020. Analyzing the data, we observe that women report a lower level of dissatisfaction, and therefore a higher level of satisfaction with online education. However, this difference is not statistically significant. On the other hand, when examining difficulties, women are more likely to highlight issues such as limited access to bibliographic resources, emotional distress, and connectivity problems or lack of technological resources. This greater concern may stem from heightened awareness, a more critical perspective, or living in disadvantaged environments. Similarly, women more frequently point out certain strengths of online education, such as increased opportunities for active participation, the ability to stay at home and avoid commuting, and better compatibility with caregiving responsibilities. In conclusion, although women adopt a more critical stance toward the negative aspects of online education, they also recognize advantages that contribute to a higher level of satisfaction.

Additionally, we would like to propose two hypotheses that may have contributed to women's improved performance in online education, although it is difficult to demonstrate this in our case. These hypotheses have been supported by findings in other studies. First, some papers suggested that women may exhibit better organization and focus during their studies compared to men (Podila (2019)) and it is well known that online education requires greater organizational skills and concentration from students. Second, another branch of the literature suggests that reduced interaction with male peers may enhance women's performance in fields such as mathematics and STEM, where men typically achieve better results. Research on classroom gender composition indicates that women tend to perform better when they are not required to interact with men (**?** and Jackson (2012)).

In summary, based on our survey, we can state that although women are aware of the negative aspects of online education, they are also able to recognize its advantages and capitalize on them. This section has primarily analyzed student behavior. However, it is also possible that changes occurred on the part of instructors or university policies that may have contributed to higher pass rates during the crisis context. We cannot confirm whether teaching behavior remained constant. Nevertheless, there is no clear reason to

stratified by admission year. In 2020, the survey was conducted between June 22 and July 1, with the participation of 1,305 students. In 2021, it was carried out between November 15 and 29, with 1,891 students participating.

believe that such support would have been disproportionately directed toward female students over male students.

Furthermore, it is important to emphasize that the context in which we are analyzing online education is part of a broader crisis scenario, which may have involved significant emotional stress. Therefore, the effects of online education might differ in a context without lockdowns or other restrictive measures.

7. Conclusions

This study contributes to the understanding of the differentiated effects of online education on men and women, using an extensive dataset from the Universidad de la República in Uruguay. Our findings reveal that, overall, women perform better in online education compared to men. Specifically, women pass more subjects and show improvement in their average grades.

Through heterogeneity and robustness checks, we understand that these findings are consistent across different faculties, including both social sciences and STEM fields, as shown in the heterogeneity analysis. Additionally, we find that women from higher-income backgrounds perform notably better.

Our analysis of potential mechanisms suggests that several factors contribute to women's success in online education. Women report higher satisfaction levels with online learning, despite expressing concerns about connectivity issues and emotional distress. Importantly, they also recognize advantages, such as the ability to stay at home and better compatibility with caregiving responsibilities. Furthermore, women may excel in online education due to their superior organizational skills and focus, which are crucial in the less structured online environment. This hypothesis aligns with psychological literature suggesting that women tend to perform better in tasks requiring higher concentration and organization. Another potential mechanism involves classroom gender composition. Women may perform better in online environments where interaction with male peers, which could be intimidating in traditional in-person settings, is reduced. This is consistent with studies suggesting that women thrive in settings where they are not competing directly with men, particularly in fields like STEM.

In comparison to previous studies, such as Erdemli (2024), which examines younger school-

age students, our results are driven primarily by individual factors rather than parental support. This highlights the importance of personal characteristics in the university context, where parental involvement is minimal.

This paper makes a significant contribution to the literature on online education and gender differences. It provides compelling evidence that online education, as a result of the COVID-19 pandemic, has had a more positive impact on women's academic performance than on men's. These findings are important for informing educational policies and practices aimed at closing gender gaps and ensuring that all students, regardless of gender or background, can thrive in digital learning environments.

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Appendix

Table A.1: **Academic performance of Women in online education in second year**

	Passed courses	Grade Point Average
Online	-0.149***	0.086**
	(0.045)	(0.042)
Women Online	0.295***	0.156***
	(0.068)	(0.063)
Observations	3,716	3,713
R^2	0.073	0.037

NOTE: This table presents estimates of the effects of online education on women, based on a difference-in-differences strategy. In particular, we compare students who enrolled in 2018 and were in their second year in 2019 with students who enrolled in 2019 but whose second year, in 2020, took place under online education. We estimate using OLS with control variables such as age, parental education, whether the individual has children, employment status, scholarship status, and the degree program they are pursuing. The columns represent the various performance indicators used as dependent variables. Column 1 shows the number of courses passed by the student and Column 2 uses a performance indicator calculated as the grade point average. Standard errors are clustered at student level. ***, **, * indicate significance at the 1, 5 and 10% level, respectively.

Table A.2: **Placebo 2018 versus 2019 and 2020 versus 2021**

	Passed courses	Grade Point Average
Placebo 1		
Online	0.075*	0.279***
	(0.043)	(0.045)
Women Online	-0.048	-0.032
	(0.064)	(0.067)
Observations	3,654	3,652
R^2	0.084	0.069
Placebo 2		
Online	-0.142***	-0.036
	(0.049)	(0.044)
Women Online	0.107	-0.000
	(0.073)	(0.066)
Observations	3,677	3,675
R^2	0.063	0.019

NOTE: This table presents two different placebo test. Placebo 1 compares two years with in-person education and Placebo 2 compares two years with online education. We present only the results estimating by OLS with control variables such as age, parental education, whether the individual has children, employment status, scholarship status, and the degree program they are pursuing. The columns represent the various performance indicators used as dependent variables. Column 1 shows the number of courses passed by the student and Column 2 uses a performance indicator calculated as the Grade point average. Standard errors are clustered at student level. ***, **, * indicate significance at the 1, 5 and 10% level, respectively.

Table A.3: **Academic performance of Women in online education by studies (estimation with Fixed Effects)**

	Courses Passed Courses	Grade Point Average
Economics and Business		
Women Online	0.073**	0.021
	(0.035)	(0.030)
R^2	0.002	0.002
Observations	7,921	7,915
Engineering		
Women Online	0.123**	0.149***
	(0.055)	(0.048)
R^2	0.002	0.003
Observations	4,080	4,074
Nursing		
Women Online	0.220**	0.191
	(0.085)	(0.150)
R^2	0.001	0.006
Observations	773	773

NOTE: This table presents estimates of the effects of online education on women for different studies estimated with individual fixed effects. The columns represent the various performance indicators used as dependent variables. Column 1 shows the coefficients for the number of courses passed by the student and Column 2 uses a performance indicator calculated as the grade point average. Standard errors are clustered at student level. ***, **, * indicate significance at the 1, 5 and 10% level, respectively.

Table A.4: **Academic performance of women by parental education level (estimation with Fixed Effects)**

	(1) Passed Courses	(2) Grade Point Average
Students with low educated parents		
Women Online	0.041	0.094*
	(0.051)	(0.051)
R^2	0.003	0.004
Observations	3,525	3,525
Students with medium educated parents		
Women Online	0.138***	0.108***
	(0.047)	(0.036)
R^2	0.001	0.001
Observations	5,009	5,004
Students with highly educated parents		
Women Online	0.170***	0.126***
	(0.051)	(0.048)
R^2	0.003	0.004
Observations	4,060	4,054

NOTE: This table reports the results separately for students whose parents have high, medium, or low levels of education, estimated using individual fixed effects. The columns correspond to the different performance indicators employed as dependent variables. Column (1) presents the number of courses passed, while Column (2) reports results using a performance measure based on the grade point average. Standard errors are clustered at student level. ***, **, * indicate significance at the 1, 5 and 10% level, respectively.

Table A.5: **Academic Performance of Woman with and without a scholarship (estimation with Fixed Effects)**

	(1) Passed Courses Passed	(2) Grade Point Average
Students with a scholarship		
Women Online	-0.037	0.166
	(0.117)	(0.107)
R^2	0.017	0.014
Observations	758	758
Students without a scholarship		
Women Online	0.124***	0.136***
	(0.029)	(0.026)
R^2	0.002	0.003
Observations	12,003	11,992

NOTE: This table presents the results separately for students who have a scholarship and students without a scholarship, estimated using individual fixed effects. The columns represent the various performance indicators used as dependent variables. The columns correspond to the different performance indicators employed as dependent variables. Column (1) presents the number of courses passed, while Column (2) reports results using a performance measure based on the grade point average. Standard errors are clustered at student level. ***, **, * indicate significance at the 1, 5 and 10% level, respectively.

Table A.6: **Academic Performance by Time Lag Between Secondary Completion and Tertiary Enrollment (estimation with Fixed Effects)**

	(1) Passed Courses Passed	(2) Grade Point Average
More than 3 years		
Women Online	-0.115	0.216
	(0.185)	(0.161)
R^2	0.017	0.014
Observations	355	353
Less than 3 years		
Women Online	0.113***	0.136***
	(0.028)	(0.026)
R^2	0.002	0.003
Observations	12,382	12,373

NOTE: This table presents the results separately for students with a gap of more than three years versus less than three years between completing secondary school and entering university, estimated using individual fixed effects. The columns represent the various performance indicators used as dependent variables. The columns correspond to the different performance indicators employed as dependent variables. Column (1) presents the number of courses passed, while Column (2) reports results using a performance measure based on the grade point average. Standard errors are clustered at student level. ***, **, * indicate significance at the 1, 5 and 10% level, respectively.