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The impact of COVID-19 on the learning during the lockdown

El impacto del COVID-19 en el aprendizaje durante el confinamiento

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ABSTRACT

COVID-19 pandemic led Spanish population to a mandatory lockdown between March and May 2020. This meant closing schools and moving the rest of the 2019-2020 academic year to an online format. This work analyses how the educational process developed during lockdown and estimates the impact that the interaction between online education and parents' teleworking situation had on students' critical thinking skills. To do this, we collected data at the beginning and at the end of the 2019-2020 academic year on critical thinking from students at the third year of secondary education from 15 educational institutions in the Region of Madrid. Firstly, we concluded that public schools faced more difficulties than private government-dependent schools for continuing with the teaching-learning process. In order to follow online classes, 70% of the students in private government-dependent

schools had a desktop or laptop compared to 40% of the students in public schools. Moreover, meanwhile 73% of the students in private government-dependent schools devoted more than 4 hours to classes and online tasks, this figure slightly exceeded 50% for students in public schools. Secondly, in general, the different work situations of parents did not have significant effects on students' critical thinking. However, we did find that, for students with academic results below the average at the beginning of the school year, the fact that the mother teleworked during school closing had a positive and significant impact on their academic results. This suggests that teleworking allowed mothers to provide greater support and supervision to their children.

Keywords: online learning, COVID-19, teleworking, critical thinking, project-based learning

RESUMEN

La pandemia del COVID-19 llevó a la población española a un confinamiento obligatorio entre los meses de marzo y mayo de 2020. Ello supuso cerrar los centros educativos y continuar el resto del curso 2019-2020 sin presencialidad. Este trabajo analiza cómo se desarrolló el proceso educativo durante el confinamiento y estima el impacto que la interacción entre la educación telemática y la situación laboral de los progenitores tuvo sobre la competencia de pensamiento crítico del alumnado. Para ello, utilizamos datos recogidos al principio y al final del curso 2019-2020 sobre el pensamiento crítico del alumnado de 3º ESO de 15 centros educativos de la Comunidad de Madrid. En primer lugar, concluimos que los centros públicos tuvieron mayores dificultades que los centros concertados para continuar con el proceso de enseñanza-aprendizaje. Para seguir las clases telemáticas, el 70% del alumnado en centros concertados disponían de un ordenador de sobremesa o portátil, frente a solo un 40% del alumnado en centros públicos. Además, mientras que el 73% del alumnado de centros concertados destinaron más de 4 horas en total a clases y tareas online, esta cifra solo superó ligeramente el 50% en el alumnado de centros públicos. En segundo lugar, y con carácter general, las diferentes situaciones laborales de padres y madres no tuvieron efectos significativos sobre el pensamiento crítico del alumnado. Sin embargo, encontramos que, para el alumnado con resultados académicos por debajo de la media a principio de curso, el hecho de que la madre teletrabajara durante el cierre escolar tuvo un impacto positivo y significativo sobre sus resultados. Ello sugiere que el teletrabajo permitió a las madres brindar mayor apoyo y supervisión a sus hijos e hijas con bajo rendimiento previo.

Palabras clave: aprendizaje en línea, COVID-19, teletrabajo, pensamiento crítico, aprendizaje basado en proyectos

INTRODUCTION

During the first months of 2020, the COVID-19 virus caused a pandemic with high human and economic costs. In the case of Spain, the beginning of the pandemic had, among many other aspects, a strong impact on the education system. The lockdown of the population from mid-March was associated with school closures and the ending of the 2019-2020 academic year electronically.

There are several studies that confirm that the educational system could not be sufficiently prepared for an emergency situation such as the one experienced, that forced a readjustment of the educational model in the form of online education (Aznar, 2020; Van Lancker & Parolin, 2020). The initial hypothesis of the studies to date concludes that the difficulties on the part of students and teachers during the pandemic were expected to be greater in public schools than in private government-dependent schools, due to the different average socioeconomic level of the students in each type of school and the different provision of educational resources in them (Schleicher, 2020), which has been called the use gap, access gap, digital gap and school gap (Fernández-Enguita, 2017; Fundación COTEC, 2020).

According to the Organisation for Economic Co-operation and Development (OECD, 2020) report, on average, just over 50% of schools participating in PISA 2018 indicated that their teachers had the technical and pedagogical skills needed to integrate technology into their teaching practice. This percentage dropped to 45% in schools in areas with lower socio-economic status but increased to 70% in schools in areas with higher socio-economic status. Furthermore, on average, just over 30% claimed to have the time, resources and digital skills to prepare content for online teaching, a percentage that drops to 25% in schools with lower socio-economic status and rises to 50% in schools with higher socio-economic status.

One of the situations that were generated on the pandemic scenery and online education was the necessity of having all the students connected to the network. It is true that not all students were able to answer to this requirement due, among other reasons, to the digital gap. As Bonal & Gonzalez (2020) point out, the family socioeconomic status, measured by the culture and economic level of the parents, could influence access to information and communication technologies. While in 2020 the 85.9% of households with incomes of less than 900 euros per month had an internet connection, only 58.2% had some type of computer (MEFP, 2021).

The declaration of the alarm state in mid-March 2020 moved the educational system to a non-face-to-face format that was developed within the family environment due to the lockdown. The families had to coordinate with the teachers so that the objectives set in the curriculum could be developed during the rest of the 2019-2022 academic year. This made it necessary to readapt the house and create

an adequate study climate and a timetable, an aspect that was largely assumed by the parents (Fodor et al., 2020; Goiria, 2015).

Likewise, the employment status and the ways of working of parents were also significantly affected by the lockdown (Farré et al., 2020). Depending on the type of previous job, many parents had to continue to carry out their work from home in telecommuting way. Other parents, due to working in essential services, continued working outside their home and a third group was unemployed or inactive. Survey-based estimates suggest that around 40% of full-time employed people in the European Union started working remotely following the outbreak of the COVID-19 pandemic (Eurofound, 2020).

On the other hand, globalization and the problems that society faces in a changing world require that education focus on the development of skills that are considered essential in the 21st century, such us creativity, critical thinking and collaboration and communication skills (Scott, 2015). Of these competences, critical thinking is a construct whose definition is constantly evolving. However, numerous authors agree that it is an intentional, reasoned metacognitive process that is goal-oriented, and that it involves skills such as interpreting, analysing, evaluating, interring and explaining that can be used simultaneously for resolution, with the greater effectiveness, of the problems that arise during daily life (Bie & Wihelm, 2015; Duplass & Ziedler, 2002; Fisher, 2021).

When it comes to acquiring these skills, numerous studies state that the socio-family context of students has a significant impact on their academic performance (Castro et al., 2015; Kim & Hill, 2015; Vázquez et al., 2020). Among other factors, academic training, as well as a high cultural level, positively influence the performance of children (Santín & Sicilia, 2016). Likewise, Castro et al. (2015) found that the greatest associations between academic performance and family factors occur when parents have higher academic expectations and are involved in school activities and in the development of reading habits. In addition, Vazquez et al. (2020) found that parents' interest and their involvement and support at home with school activities correlate positively with their children's performance. Although in general terms the studies analysed do not show differences associated with the gender of the parents, Kim and Hill (2015) discovered in their meta-analysis that, although the relationships between involvement and performance were equally strong in both parents, the middle levels of involvement of mothers were higher.

This research aims to analyse the impact that non-face-to-face education caused by the mandatory lockdown that caused the COVID-19 pandemic, had on the educational process. To this end, two specific objectives are addressed. In the first place, the differences experienced are described, both in the resources available to continue receiving education online and in the number of hours of virtual classes and homework received, between public and private government-

dependent schools. Secondly, the impact that the interaction between telematic education and the employment situation of the parents during the school closure had on the students' critical thinking skills is analysed. Based on these objectives, the following hypotheses are stated:

— H1: During the lockdown, students in private government-dependent schools had a better environment to develop education online.
— H2: The different work situations of the parents during the lockdown had different effects on the critical thinking skills of their children.

The main results obtained show that there was a digital gap that allowed students in private government-dependent schools to receive a higher quality online education. They also show that students with below-average results whose mother was teleworking improved their results compared to students whose mothers were in a situation other than teleworking.

To explain how these conclusions have been obtained, the following section discusses the research design, as well as data collection and the analysis technique used. The third section presents the details of the results achieved and, finally, the last section is dedicated to presenting the main conclusions of this research.

METHOD

Participants

To carry out the study, a sample of students in the third year of compulsory secondary education enrolled in schools in the Community of Madrid is used, which were selected using the non-probabilistic casual sampling technique (Otzen & Manterola, 2017). The sample includes 15 educational schools, of which 9 were publicly owned and 6 were private government-dependent schools. Specifically, we obtained 243 observations with valid responses; of these, 107 correspond to students enrolled in public schools and 136 to students from private government-dependent schools. Of the total sample, 136 are girls and 107 boys, with an age of 14.17 years on average. In relation to their socioeconomic characteristics, 94% of the students surveyed are native (born in Spain) of parents with, mainly, higher education (tertiary studies or higher vocational training), who cohabit at home with both parents (77% of the sample).

Procedure

The recruitment of the schools was carried out between February and September 2019. The initial objective was to recruit 20 schools that provide compulsory

secondary education in the Community of Madrid for a different study from the one presented here. To do this, all publicly owned and private government-dependent schools in the community were contacted, in such a way that the first 20 schools that sent the commitment letter would be chosen to participate in the study. In March 2020, due to the pandemic and the school closure, the objective of the study was modified in order to carry out a first exploration of the exceptional situation that the Spanish educational system was experiencing. Additionally, the number of schools that expressed their interest in continuing to participate in the study was reduced.

In October 2019, students completed baseline questionnaires on the computers of the participating schools under the supervision of teachers. These questionnaires included questions to measure skills in critical thinking and to know the family socioeconomic context of the students. The endline questionnaires, due to the school closure, were implemented at the end of May 2020 on the digital devices that the students had available at home. The endline questionnaire included questions to measure the student's critical thinking and, in addition, a new block of questions related to schoolwork at home during lockdown was incorporated. With the new questions, the objective was to know the availability and use of technological tools for distance learning, but also the interaction of students with their families during this period.

Instruments

To measure competence in critical thinking, we used questions taken from standard critical thinking assessments such as the Cornell critical thinking test, questions released from questionnaires of the PISA program, as well as from an adaptation to the age of the students of the Watson-Glaser Critical Thinking questionnaire (Watson & Glaser, 1980).

The questions that were finally considered in the baseline and endline questionnaires were previously adapted and calibrated by an external sample of 26 youths of similar ages to the project participants. During calibration, questions where all answers were correct or incorrect were discarded and replaced by similar ones. Subsequently, the questions were grouped in such a way that the expected average score, that is, the difficulty, in both questionnaires was similar. In the baseline questionnaire (pre-test) 6 questions on critical thinking were included, while in the endline questionnaire (post-test) 18 questions were included. In both cases, each question was assigned a score of 1 if the answer was correct and 0 otherwise. In order to standardize the scale of these two tests, the scores obtained in the pre-test were multiplied by three. In this way, the minimum score in both tests is equal to 0 and the maximum score is 18.

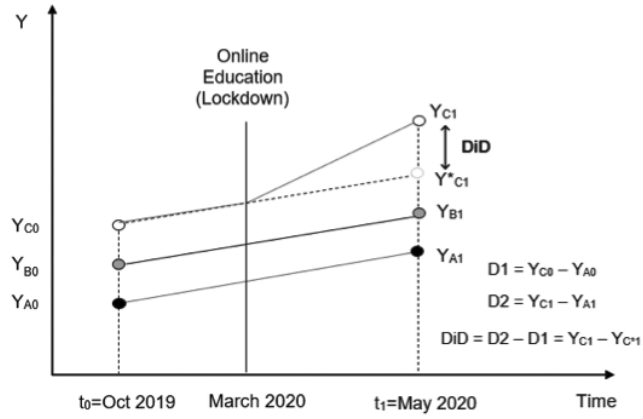
Secondly, to analyse whether the parents' work situation during the lockdown and school closure affected their children's performance in relation to critical thinking, we have classified the parents' work situation into three main groups: teleworking; working outside the home; or not working. Since for most of the pupils both parents live together at home, work situations during lockdown are considered both separately for each parent and jointly for both parents.

Analysis of data

To provide answers to the research questions, data analysis is carried out using the statistical software STATA 17®. In the first place, to analyse the educational process in public and private government-dependent schools during lockdown, we carried out a descriptive analysis. Second, to isolate the impact that the employment situation of parents generated by the pandemic has on the critical thinking of their children, we chose the Difference-in-Differences (DiD) model (Schlotter et al., 2011).

The DiD method calculates the differences between the average values of the outcome variable before and after the program or exogenous change that causes the effect on the variable and whose impact is to be analysed. In our case, it calculates the differences between the average values of the students' results in the critical thinking test before and after the lockdown, grouping the students by the type of work of their parents. Figure 1 illustrates the strategy of this methodology to calculate the impact of an intervention or an unexpected exogenous shock. The two periods are shown on the x-axis: t=0 and t=1 to indicate the situations before and after lockdown, respectively. The y-axis shows the average score of each group of students in the critical thinking test. In the period t=0 (October 2019) we observe the different results of the three groups A, B and C. The first difference between any pair of groups (D1) includes differences due to observable and unobservable situations prior to the lockdown. The second difference between any pair of groups (D2), in addition to the previous pre-existing factors, also incorporates the changes caused in the groups due to the lockdown measured at t=1 (May 2020). If the three groups had been affected equally, we would observe a parallel trend where the differences would be maintained or in any case the changes in the average differences would not be statistically significant. To isolate only the effect of interest, it is necessary to calculate the difference between the two differences D1 and D2, before and after the lockdown, respectively, which is the estimate of the differential impact that the lockdown creates, if any, in any of the three groups relative to the other two. Once calculated, it is determined by a statistical procedure whether it is statistically different from zero.

Figure 1
Representation of the Difference-in-Differences (DiD) methodology



The estimation of the effect of the employment situation of the parents on their children's results was carried out using the information from the baseline and endline questionnaires, using the following model:

$$y_{ist} = \alpha_i + \beta t + \delta T_{is} + \gamma t T_{is} + \tau X_{is} + \eta S_s + \varepsilon_{is} \quad (1)$$

where Y_{ist} corresponds to the score in the critical thinking test of student *i* who belongs to school *s* in period *t*, *t* is a dichotomous variable that indicates the time and that takes value 0 before the school closing (baseline questionnaire) and value 1 after school closing (endline questionnaire), T_{is} collects the employment situation of the parents of student *i* during lockdown and, therefore, the coefficient γ of the interaction of *t* and T_{is} collects the impact of the employment situation on the result of the student critical thinking test that occurred during lockdown. Finally, X_{is} corresponds to the control variables associated with the student and the school, captures the fixed effect of each school and S_s is the error term. This model was estimated using ordinary least squares with school fixed effects and using robust errors.

RESULTS

Differences in the educational process between public and private government-dependent schools during lockdown

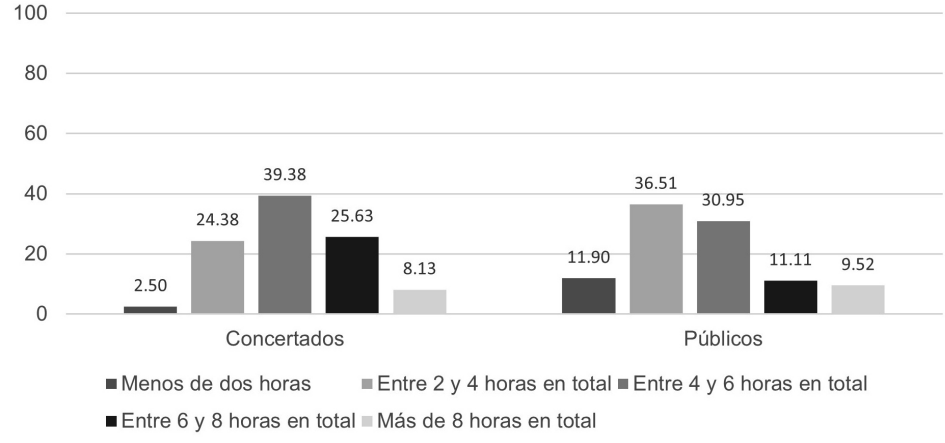
Regarding the devices used by the students to contact the teaching staff and follow the classes online, it should be noted that while almost 70% of the students

in private government-dependent schools had a desktop or laptop computer for their exclusive use, this figure drops to 40% in the case of public schools. The use of mobile phones to connect with online educational activities became the most chosen option, or the only one available, by students in public schools, almost 50% always used it. In the case of students from private government-dependent schools, the mobile phone ranked second with a frequency of 38%. Also noteworthy is the use of tablets for exclusive use as a regular method among students, to a greater extent in public schools (31%) than in private government-dependent ones (around 20%).

Figure 2 shows the average number of hours per day of online lessons and homework received by students. While 73% of students in private government-dependant schools spent more than 4 hours in total on online lessons and homework, this figure was only slightly above 50% for students in public schools. It is worth noting the difference in average daily homework time between students in both type of schools in the higher ranges, in favour of private government-dependent schools. While 1 out of 3 students in private government-dependent schools claimed to spend, on average, between 6 and 8 hours in class and studying, in the case of public schools this proportion drops to 1 out of 5 students. The opposite occurs in the lower ranges, where we find that almost 50% of students in public schools spent less than 4 hours per day on schoolwork, while this figure was around 27% in private government-dependent ones. Considering that during a regular period of face-to-face teaching an student from secondary education usually has at least 6 hours of teaching per day, the results obtained are

Figure 2

Hours per day of online classes or homework (% of students)



particularly negative for students in public schools. In other words, the aforementioned gap in access to digital resources at home has been reinforced by a gap in access to and use of telematic educational resources among pupils in each type of school.

The results also show that almost 70% of the students had very limited, or no, classes recorded by the teaching staff to be consulted asynchronously. In the case of public schools, the percentage of those who confirmed that they did not have access to recorded classes rose to 36%, compared to 21% in private government-dependent schools. These differences could be explained by the lower technical and pedagogical skills needed to integrate technology into the teaching practice of teachers in public schools, with lower socioeconomic levels (OECD, 2020).

In addition, more than 60% of the students had additional activities that helped them to better understand the subjects. In other words, the students received a teaching more focused on carrying out tasks with feedback from the teacher than in a teaching focused on online classes. Although 50% of the students declared facing some type of difficulty in following the subject of mathematics, the differences were not significant between both type of schools. With reference to the availability of self-assessment exams, we observed that while 70% of the students in private government-dependent schools confirmed having them with some regularity, this only occurred in 53% of the cases in public schools. In relation to the availability of books and online material for the subjects, the percentages are similar, stating that 73% of the students in private government-dependent schools had them compared to 45% of the students in public schools. These differences in favour of greater educational activity in private government-dependent schools compared to public ones are in line with the results obtained in Moreno and Gortázar (2020). The greater deficit in the supply of telematic educational resources in public schools has also been reinforced by the lower capacity of parents with a lower level of education and income to accompany their children in the process of learning at home.

Finally, it is worth mentioning life habits during lockdown. More than 60% of the students confirmed that they were easily bored during the lockdown, despite declaring that they had more free time to do things they really enjoyed. In addition, almost 80% of the students surveyed missed their classmates very much, and most of them confirmed that their relationship with their family had improved. In addition, we found that 55% of the pupils played less sport during the lockdown and 45% of the pupils stated that they ate more during the lockdown than before it.

Impact of parental employment status on critical thinking outcomes in the lockdown

As noted above, the COVID-19 pandemic was an unexpected exogenous change that, among other sad consequences, paralysed face-to-face education and altered the structure of the labour market. The state of alarm shifted the education system to an online format that developed and interacted with the family environment due to the lockdown.

In this section we analyse whether the parents' work situation during the lockdown and school closing affected their children's educational outcomes, as measured by the questions on critical thinking. To do so and taking advantage of the fact that we had the results of the baseline questionnaire, we applied a DiD model to the 243 students who answered baseline and endline questionnaires and could therefore match their responses.

In addition to the critical thinking outcome variable, three categories were created to indicate the parents' work situation during lockdown as shown in Table 1. The employment status of parents during lockdown basically took three forms: teleworking, working outside the home because they belonged to essential sectors, or not working. In addition, in the estimation of the effects we have incorporated a set of control variables associated with the students that did not change with the COVID-19 shock and at the same time are associated with the outcome in critical thinking. Based on the available literature, we include as control variables the students' gender, their immigrant status (whether they are first-generation immigrants), father's and mother's educational attainment, family type and school ownership (Calero et al., 2009; Cordero et al., 2013; Santín & Sicilia, 2016).

As discussed above, there may be differences in observable and unobservable characteristics of parents that influence both their employment status and student outcomes, it is necessary to estimate a DiD model to control for these initial differences in order to obtain robust estimates of impact.

Table 1
Model variables

Variable type	Variables	Definition
Dependent variable (y)	Critical thinking score	Responses to critical thinking tests in questionnaires. Score between 0 and 18.
COVID-19 induced work status (T)	Work status of mothers and fathers during lockdown	Dummies for mothers and fathers according to type of work during lockdown: telework; work outside home; not working

Variable type	Variables	Definition
Covariates (X)	Type of family	Student lives continuously with biological mother and father (nuclear family) = 1; Otherwise = 0
	Gender	Girl = 1; Boy = 0
	Type of school	Private government-dependent schools = 1; Public = 0
	1st-generation immigrant	First-generation immigrant student= 1; Otherwise = 0
	Parents' level of education	Dummies for mothers and fathers in the following categories: Compulsory education or less; Post-compulsory non-tertiary education (baccalaureate, higher vocational training); Tertiary education; Student does not know parents' level of education.

The DiD model (equation 1) explained above was first estimated for the whole sample of students. Furthermore, to analyse whether the work situation affected all students equally, the sample was divided into two groups: students with an initial pre-test score in critical thinking below the average (low score) and students with a pre-test score above the average (high score). Table 2 shows the average scores of the three groups: all students, below-average students, and above-average students according to the mother's[1] employment status during lockdown.

Table 2 shows how, for the whole sample of students, the results after lockdown are significantly lower than before lockdown (-0.82 points). However, while for students with above-average scores the performance decreases markedly (-2.84 points), it increases for students who had a below-average critical thinking score in the pre-test (+2.06 points). After lockdown it can be seen that the gap between the two groups of students still exists, but it is smaller.

[1] The econometric models were estimated by ordinary least squares with school fixed effects and using robust errors. For simplicity only the results for the mother's employment status are presented, as all other categories associated with the father, or the combination of father and mother's jobs were not found to be statistically significant. Full results are available on request. Similar results were found in Italy, where fathers' involvement in their children's educational process during lockdown had no influence on their children's academic progress (Mangiavacchi et al., 2021).

Although Table 2 describes the initial (pre-lockdown) and final (post-lockdown) situation of the three groups of mothers' work status, in order to know whether any of them had an impact on their children's learning compared to the other groups it is necessary to estimate the DiD model of equation 1 where two differences are considered: (i) the difference between the average values of students' scores in the critical thinking test before and after lockdown and, (ii) the difference between groups of students according to the work status of their parents.

Table 2

Pupils' average scores in critical thinking before and after lockdown according to the mother's employment

	All students			Below the pre-test average			Above the pre-test average		
	t_0	t_1	Diff.	t_0	t_1	Diff.	t_0	t_1	Diff.
Telework	11.76	11.00	-0.76*	7.89	10.56	2.67***	13.50	11.20	-2.30***
	(3.14)	(2.66)		(1.70)	(2.72)		(1.79)	(2.63)	
Observations		87			27			60	
Works outside	10.35	9.14	-1.21*	6.18	8.21	2.03***	13.97	9.95	-4.02***
	(4.72)	(2.94)		(3.09)	(3.11)		(2.24)	(2.56)	
Observations		71			33			38	
Not working	10.34	9.76	-0.58	7.13	8.80	1.67***	13.20	10.62	-2.58***
	(3.69)	(2.96)		(2.51)	(2.94)		(1.62)	(2.73)	
Observations		85			40			45	
All	10.85	10.03	-0.82***	7.02	9.08	2.06***	13.53	10.69	-2.84***
	(3.89)	(2.94)		(2.60)	(3.06)		(1.88)	(2.67)	
Observations		243			100			143	

*Note. t_0 refers to the score on the pre-test (applied before lockdown) and t_1 refers to the score on the endline questionnaire (applied during lockdown). Standard deviation in brackets. The column 'Diff' is computed as the difference of columns t_0 and t_1 and indicates whether the difference is statistically significant with respect to the average at t_0 as follows: *p<.10, **p<.05, ***p<.01 indicates significant at 90%, 95% and 99% respectively*.

In the general model for all students, no significant effects of the mothers' employment status on the results of the critical thinking test were found. There was also no significant effect of mothers' employment status on the results of students who were above average in the pre-test. In general, in these groups, no significant effect of mothers' work status was found during the time of non-face-to-face learning.

Table 3

Impact of the mother's employment status on her children's critical thinking during lockdown and online learning in the 2019-2020 academic year

All students	1st Difference (before lockdown) (A)	2nd Difference (after lockdown) (B)	DiD (without controls) (B) – (A)	DiD equation 1 (with controls) (B) – (A)
Telework Vs Not working	1.43***	1.32***	-0.10	0.38
Telework Vs Work outside	1.41**	1.86***	0.45	0.40
Work outside Vs Not working	0.02	-0.54	-0.56	-0.02
Pupils below average	**1st Difference (before lockdown) (A)**	**2nd Difference (after lockdown) (B)**	**DiD (without controls) (B) – (A)**	**DiD equation 1 (with controls) (B) – (A)**
Telework Vs Not working	0.86	1.85**	0.98	1.93*
Telework Vs Work outside	1.71**	2.34***	0.64	0.90
Work outside Vs Not working	-0.85	-0.50	0.35	1.03
Pupils above average	**1st Difference (before lockdown) (A)**	**2nd Difference (after lockdown) (B)**	**DiD (without controls) (B) – (A)**	**DiD equation 1 (with controls) (B) – (A)**
Telework Vs Not working	0.24	0.67	0.42	0.26
Telework Vs Work outside	-0.47	1.25**	1.73**	0.75
Work outside Vs Not working	0.72	-0.59	-1.31*	-0.49

Note. Estimates include school fixed effects. Our preferred model is the estimation of coefficient γ in equation 1 that is captured by the last column of the table. *p<.10, **p<.05, ***p<.01 indicate significant at 90%, 95% and 99% respectively.

However, for students who had low critical thinking scores on the pre-test, we did find that the mother's teleworking during school closing had a positive and significant impact on the results compared to other work situations. This effect increased the mean of this group of students by 1.93 points on the critical thinking test or 0.74 standard deviations from the initial distribution of scores. This result seems to suggest that the fact that mothers worked from home enabled them to provide greater support and supervision to their underachieving children during their learning process, support that they are not normally able to provide on a sustained basis throughout the day. Although the literature is not conclusive on telework and gender, there are previous studies whose results are consistent with the findings of this study. Some empirical research shows that women who telework spend the time they save on commuting on household chores and childcare and,

at the same time, consider telework to be beneficial in achieving a better work-life balance (Hilbrecht et al., 2008). Along these lines, Kurowska (2020) concludes that women's greater responsibility for childcare tasks when teleworking may help to maintain more conservative gender roles. Men, on the other hand, tend to increase their work intensity when working from home (Chung & Van der Lippe, 2020). For the specific case of Spain, according to Farré et al. (2020), mothers' involvement in childcare increased regardless of their partners' employment status.

DISCUSSION AND CONCLUSIONS

Beyond the dramatic situation caused by the COVID-19 pandemic worldwide, in the educational context, the 2019-2020 academic year will sadly go down in history as the year in which schools closed their doors and students and teachers finished the academic year at home telematically.

In accordance with the first hypothesis, the first result of this study is that there were some clear differences between the educational practices followed in public and private government-dependent schools, which lead to the conclusion that the latter ones had a more favourable environment for developing online education. Thus, while almost 70% of pupils in private government-dependent schools had a desktop or laptop computer for their exclusive use to connect with the lessons and their teachers, this figure fell to 40% of pupils in public schools. Moreover, while 73% of pupils in private government-dependent schools spent more than 4 hours in total on online classes and homework, this figure was only slightly above 50% for pupils in public schools. The use of mobile phones by almost 50% of students in public schools meant that a large percentage of students in this type of school did not have the necessary resources to be able to properly monitor non-face-to-face lessons. Although the mobile phone made up for the lack of computers or tablets, its use did not allow for quality online teaching. This digital access gap between students in each type of school could be explained mainly by the differences in the socio-economic level of the families attending both types of school (Fernández-Enguita, 2017; Fundación COTEC, 2020; Schleicher, 2020).

The second result is that the pandemic generated a natural experiment in the employment situation of parents whereby some parents went on to telework while others, in charge of essential services, had to continue working outside the home, and a third group was unemployed or inactive. In relation to the second hypothesis, once the initial differences between the three groups in the critical thinking test and other covariates such as parents' educational level, immigrant status, gender or type of school are taken into account, the overall DiD model estimated for all students finds no significant effects of any employment status of the mothers on the critical thinking test score with respect to the other groups. Nor were significant effects

of mothers' employment status on the results found for students who performed above average in the pre-test.

However, for students who scored below the average in critical thinking in the baseline test, we did find that the fact that the mother teleworked during school closing had a positive and significant impact on their results of 0.74 standard deviations. This result seems to indicate that for accompaniment during the learning process to be effective, mothers need to have more time at home, as well as the cognitive skills and abilities to do so. The possibility for some mothers to telework captures both dimensions. On the one hand, telework seems to be associated with professions that require a medium or high level of education (Espinoza & Reznikova, 2020). On the other hand, it allowed them to have additional time to provide more support and supervision to their children during their learning process.

This was not the case for students who performed well in the pre-test, probably because they require less supervision from their parents as they have developed better study habits and higher non-cognitive skills. This result is in line with recent international evidence (Grewenig et al., 2020).

Finally, it should be noted that all these results should be interpreted with caution since the sample with which we have worked does not represent the reality of either the Community of Madrid or the Spanish population. It will be necessary to carry out further research based on a representative sample in order to try to quantify the digital gap that exists in the Community of Madrid and in other autonomous communities. However, the results found do reveal behavioural patterns that should be taken into account in order to promote the reconciliation of work and family life and to the extent that virtual education has more weight.

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APPENDIX

Table A.1

Pupils' average score in critical thinking before and after lockdown according to parents' employment status

	All students			Below the pre-test average			Above the pre-test average		
	t_0	t_1	Diff.	t_0	t_1	Diff.	t_0	t_1	Diff.
Telework	11.65	10.55	-1.10*	6.91	9.39	2.48**	13.64	11.04	-2.60***
	(3.84)	(3.07)		(2.92)	(3.46)		(1.99)	(2.78)	
Observations		78			23			55	
Works outside	10.50	9.76	-0.75	6.98	8.92	1.94***	13.74	10.53	-3.21***
	(4.10)	(2.87)		(2.70)	(2.85)		(1.88)	(2.70)	
Observation		109			52			57	
Not working	10.35	9.71	-0.65	7.04	9.00	1.96**	13.07	10.29	-2.78***
	(3.57)	(2.87)		(2.14)	(3.28)		(1.68)	(2.43)	
Observations	56				25				31
All	10.85	10.03	-0.82***	7.02	9.08	2.06***	13.53	10.69	-2.84***
	(3.89)	(2.94)		(2.60)	(3.06)		(1.88)	(2.67)	
Observations		243			100			143	

Note. t_0 refers to the score on the pre-test (applied before lockdown) and t_1 refers to the score on the endline questionnaire (applied during lockdown). Standard deviation in brackets. The column 'Diff' is computed as the difference of columns $t_{0 \text{ and }} t_1$ and indicates whether the difference is statically significant with respect to the average at t_0 as follows: *p<.10, **p<.05, ***p<.01 indicates significant at 90%, 95% and 99% respectively.

Tabla A.2

Impact of parents' employment status on their children's critical thinking during lockdown and online learning in the 2019-2020 academic year

All students	1st Difference (before lockdown) (A)	2nd Difference (after lockdown) (B)	DiD (without controls) (B) – (A)	DiD equation 1 (with controls) (B) – (A)
Telework Vs Not working	1.30*	0.85	-0.46	-0.06
Telework Vs Works outside	1.14*	0.79*	-0.35	-0.29
Works outside Vs Not working	0.16	0.56	-0.11	0.23
Pupils below average	1st Difference (before lockdown) (A)	2nd Difference (after lockdown) (B)	DiD (without controls) (B) – (A)	DiD equation 1 (with controls) (B) – (A)
Telework Vs Not working	-0.13	0.39	0.52	1.54
Telework Vs Works outside	-0.68	0.47	0.54	1.22
Works outside Vs Not working	-0.63	-0.08	-0.01	0.32
Pupils above average	1st Difference (before lockdown) (A)	2nd Difference (after lockdown) (B)	DiD (without controls) (B) – (A)	DiD equation 1 (with controls) (B) – (A)
Telework Vs Not working	0.57	0.75	0.19	-0.28
Telework Vs Works outside	-0.10	0.51	0.61	-0.30
Works outside Vs Not working	0.67	0.24	-0.43	0.02

Note. Estimates include school fixed effects. Our preferred model is the estimation of coefficient γ in equation 1 that is captured by the last column of the table. *p<.10, **p<.05, ***p<.01 indicate significant at 90%, 95% and 99% respectively.