Influence of Social and Organizational Changes Resulting from COVID on Teacher's research

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Abstract **– The arrival of COVID-19 meant a drastic change in the way of teaching and research. This paper explores the effect that the measures taken to contain the COVID-19 spreads have had on the research activities of teachers about variables such as area of knowledge, educational level, and role in projects or gender. To this end, an online survey was designed to collect data, requesting information about time lost in research, the number of papers proposed for publication in scientific journals, difficulties in managing research projects, guarantees in project funding or the capacity to reformulate research activities. Two hundred seventy-one teachers and researchers were asked to participate. Among the main results, most respondents agree on the difficulties in managing their projects; they have been forced to reformulate their research, although they claim that the time lost in research has been limited. The results will help to make decisions on the measures to be taken to alleviate the low performance of research by teacher-researchers during this period and to prepare contingency plans to reduce the impact.**

DOI: 10.18421/TEM113-09
https://doi.org/10.18421/TEM113-09

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Received: 12 May 2022.
Revised: 12 July 2022.
Accepted: 19 July 2022.
Published: 29 August 2022.

Keywords **– COVID-19 impact, investigation projects, higher education institutions, teachers, researchers.**

1. Introduction

In March 2020, following a detailed study of COVID-19 disease caused by a new SARSCoV-2 severe acute respiratory syndrome coronavirus, the World Health Organization [WHO] determined that it could be characterized as a pandemic due to its severity and high transmission rate. It was found to be a highly contagious disease that causes respiratory symptoms that, while in many cases may be mild, could be fatal. By March 2022, the number of cases worldwide exceeded 466 million, and deaths reached 6 million people [1].

In an attempt to slow the spread of this disease, world leaders have taken security measures that have never been seen before in our recent history. In general, although depending on the levels of contagion in each country, they have determined mandatory domestic confinement periods, limitation of free movement of people, mandatory use of masks and specific guidelines for improving hygiene.

This unprecedented situation has had substantial political and economic consequences worldwide, although social relations have undoubtedly suffered the most significant impact. Isolation measures and the fear of contagion have radically modified how we behave and interact in work, educational or entertainment environments [2].

In particular, social distancing measures, such as home isolation, adaptation to working from home or the impossibility of travelling to other cities or countries, have led to the appearance of numerous obstacles in work carried out by research professionals, both during the development of their research and in the allocation and execution of research projects.

Research work is enriched by all the contributions it can receive, both internal, resulting from the work of the different members of the research group from which the study originates as well as from the reviews, criticisms and points of view of external experts who offer different approaches and new ideas of thought that allow the authors to achieve quality results. It constitutes a cooperative effort in many areas of knowledge, which leads most researchers to join and create competitive research teams, actively participate in national and international scientific seminars and congresses, and establish connections with collaborative networks of excellence.

However, researchers have encountered limitations to meet at their work centre since the pandemic. They have not been allowed to stay at other research centres and universities or attend face-to-face meetings or scientific gatherings. Although, these restrictions have been overcome thanks to the communication channels made available by technology, such as video conferences or virtual congresses, these have meant long periods of adaptation for researchers. For this reason, their work has been halted or slowed down.

It should also be taken into account that many researchers also carry out teaching work, as is the case of university teaching and research staff. The adaptations applied in teaching have also meant a lot of time spent on training for their adaptation to virtual teaching and the reorganization of their subject schedules. For example, in work developed by Almaghaslah and Alsayari [3] with university professors, it is evident how the adaptation of teaching to virtual mode was effectively implemented. However, research work, community service and attendance at scientific conferences were negatively affected.

The impact of isolation measures has been greater in the case of research requiring field studies. For example, in social sciences, face-to-face surveys or personal interviews have been dispensed. It has forced researchers to disseminate the objective of their work online, request participation, send the instrument, and collect the data. All of this is done online, with the negative aspects that potential survey participants may attach to this means of communication. Firstly, they may feel a lack of confidence in the process, which may cause them to decide not to participate. On the other hand, the randomness of the sample is not guaranteed, a sample selection bias may be introduced, and relevant information characteristic of face-to-face personal interviews may be lost compared to those conducted online. In turn, in disciplines belonging to the Sciences or Health Sciences, studies carried out with animals or plants in laboratories or specialized facilities have had to be abandoned because the confinements have not allowed them to be adequately cared for.

Recently, we have witnessed the great interest that COVID-19 has been causing among researchers worldwide and its effects on humans, the process of obtaining vaccines and medical treatments that curb its symptoms. It has led to an exponential increase in research on this subject. Thanks to this, it has been possible to implement treatments to combat the biggest global pandemic. Not surprisingly, most of the research related to the virus and its treatment has had all the resources it has required at its disposal. Furthermore, this has encouraged their rapid development.

However, this is not the case with other research not directly related to the virus and its treatment, which has been dramatically slowed down or even stopped for the reasons given above. It has also occurred in medicine studies [4]. The difficulties encountered can be measured through the time lost in the research process, the need to reformulate the research work, the number of scientific articles submitted for publication since the restrictions began, or the difficulty in managing research projects. Along the same lines, the work developed by Chernogorova et al. [5] determines limitations inherent to any research project which have also been affected by the pandemic. They are the duration of a research project, the possibility of its extension, the available budget, the possibility of transferring funds from one activity to another, and the achievement of the objectives set.

Therefore, having clarified the negative effect that the pandemic has had on the research process not directly related to COVID-19, this work aims to deepen our knowledge of this effect and all the consequences derived from it. To this end, we have investigated how different factors such as area of knowledge, educational level, role in projects, or gender affect the intensity of this effect.

Among the few investigations related to the effects of the pandemic on scientific production, the one carried out by Casado-Aranda et al. [6] stands out. They conducted a bibliometric study of scientific production in which the effects of COVID-19 in the environment area were considered.

The impact of the measures is taken because pandemic has been evaluated from different points of view in the educational field. For example, Onyeaka et al. [2] address the effect of confinements due to the pandemic at the global level in areas such as food security, economy, tourism, hospitality and education, among others. Also, Kim and Asbury [7] studied the experiences of a group of teachers during the first two months of home isolation in the United Kingdom. On the other hand, Akour et al. [8] analyzed the psychological state, the obstacles of

virtual teaching and the concerns faced by university teachers in Jordan due to the control measures and quarantines established related to COVID-19. In the same vein, Sahu [9] highlights the impact on the educational and mental health aspects of university students and faculty due to the pandemic.

Among the research that considers the effects of the pandemic on research work, we highlight Almaghaslah and Alsayari [3]. They evaluated the satisfaction of university professors in Saudi Arabia with the change of teaching to virtual mode and its effects on their research and administrative work. Also, Chernogorova et al. [5] analyze the activities carried out during the development of a research project that has been put at risk after the measures imposed by the pandemic. However, practically no works address the difficulties and limitations that research in all disciplines has suffered due to the distancing measures imposed in all countries.

All of the above supports the need and interest to address this work in order to expand the existing knowledge on this subject at this time. The correct development of research carried out in the different scientific fields is vital, even in tumultuous times such as those experienced recently. The progress of society depends on this development not being stopped or slowed down. Therefore, in-depth knowledge of the influence that the scenario caused by the pandemic has had on the research process will allow us to evaluate the taking of different decisions to reduce the negative impact of the situations experienced during the year 2020.

2. Research Methodology

In order to investigate the influence that consequences derived from COVID-19 have had on the research process, a quantitative study was carried out. To this end, an ad hoc questionnaire was designed to analyze the factors that determine this influence to a greater or lesser extent. To this end, data were obtained from 269 teacher-researchers from different higher education institutions in Ecuador. The substantive functions of these institutions are teaching, research and liaison with society, under the regulation of the Higher Education Council [CES]. After a brief descriptive study, different contrasts of comparison hypotheses were carried out that allowed us to verify which factors determine influence to a greater extent. Finally, and due to the qualitative nature of most of the variables collected, an analysis of nonlinear canonical correlations (OVERALS) was carried out. It allowed us to establish a relationship structure between the influence of the pandemic and the factors considered for different aspects of the research process.

- Instrument

The instrument chosen to carry out this research is the questionnaire because of its ease of distribution at a time when the need to control the pandemic makes it necessary to continue with the restrictions. Due to the unprecedented situation experienced, there is no instrument in the previous scientific literature that allows us to collect the necessary information to achieve the proposed objectives. For this reason, we opted for the elaboration of such a questionnaire.

In addition to the characteristics of the teacher-research personnel surveyed and the research process, the questionnaire addresses other aspects such as training received or attendance at congresses and online courses, not directly related to this research.

Once the questionnaire had been designed and evaluated by a panel of experts made up of six researchers from different areas, it was modified based on the recommendations received and distributed to a pilot sample of 25 teacher-researchers. These teachers were then interviewed to analyze the difficulties encountered in understanding the wording of the questions and evaluate the insertion or elimination of others. It allowed further improvement of the questionnaire.

The questions related to the characteristics of the researcher made it possible to obtain variables such as: gender, age, marital status, area of research, level of studies and major role in the projects, in the case of having one in force, among others. On the other hand, those related to the research process were mainly:

- Rate from 1 (none) to 4 (a lot) the time you have lost in your investigations due to the consequences of COVID-19;
- Please indicate the most common situation with your research: (have been stopped/have looked for alternatives to continue/have switched to COVID approach / have continued / other);
- Number of articles submitted to a scientific journal since the pandemic began;
- If you have a research project in progress, do you think you have secured funding? (no / not sure / yes);
- If you have a research project in progress, please rate from 1 to 5 the difficulty of managing the project during the pandemic (from 1: very easy to 5: very difficult);
- If you have a research project in progress, please indicate if you think it is possible to reformulate it due to the difficulties derived from the pandemic (no / maybe / yes).

- Sample

Once the questionnaire described above had been prepared, a random sample of teacher-researchers in

Ecuador was asked to complete it. The inclusion criterion was also that their line of research should not be directly linked to COVID-19 and its treatment. Thus, the sample information was obtained using simple random sampling. An attempt was made to seek the representation of teachers and researchers from the entire national territory and all areas of knowledge to allow inference of the results.

Data collection was carried out between October 5 and 25, 2020, by sending the questionnaire by e-mail to randomly selected participants. More than 400 applications were sent. In the end, 272 responses were obtained, of which one was discarded because he/she works outside the national territory of Ecuador.

About the researcher's profile, the predominance of the female gender (56.7%), as opposed to the male gender (43.3%), is noteworthy. In addition, the most frequent age groups are between 30 and 39 years (30.8%) and between 40 and 49 years (28.6%). Although a priori is not a relevant variable for the research process, it was decided to ask about marital status to provide information on the respondent's profile. In this regard, it should be noted that the most common marital statuses are married (48.7%), followed by single (26.9%).

In information directly related to the research process, the presence of all areas of knowledge stands out in similar percentages, as was sought in the sampling process. The different educational levels are also represented in the sample, from Graduate (17 %) to Doctor (15.1 %), although the most frequent is the Master's degree, with slightly more than half of the respondents. On the other hand, the participation in projects of these teachers and researchers is also very diverse. They range from those not involved in any project (36.1%) to those who participated as principal investigators (19.7%).

- Data analysis

As can be deduced from the previous explanation of the variables involved in this study, they are qualitative, both nominal and ordinal. This characteristic imposes the need to perform a qualitative type of data analysis. In this case, the non-parametric Mann-Whitney and Kruskal-Wallis tests were applied to analyze the influence that the profile of the teacher-researcher has on the variables related to the research process.

These variables can be classified into independent variables (related to the profile of the teacher-researcher) and dependent variables (related to the research process and research project management).

Once the existence of relationships between both sets of variables was detected, a nonlinear canonical correlation analysis (Overalls) was applied to analyze the validity of the relationship between both sets and try to explain the nature of the existing relationships. The latter resulted in the creation of different teacher-researcher profiles based on the influence that COVID-19 has had on their research work.

The procedure of data tabulation and application of the different statistical data analysis methods was carried out with IBM SPSS Version 25 software.

3. Research Results

As indicated in the previous section, respondents were asked about the number of articles submitted to a scientific journal for publication since the first COVID-19 related restrictions began around mid-March 2020. They were also asked to assess the time lost in ongoing research since the restrictions began in the country and the degree of difficulty encountered in managing ongoing research projects.

First, the response percentages for the six variables analyzed are shown, which provides information on the influence that the situation resulting from COVID-19 has had on research (Table 1).

On the one hand, 67.1 % of the respondents affirm that the time lost in research is none or little. In contrast, more than 60 % of the research work has been stopped or reformulated. In addition, almost three-quarters of the participants claim not to have submitted an article to a scientific journal in the last few months. On the other hand, 63.4 % claim not to have secured project funding for reasons arising from the pandemic, and 71.4 % consider it difficult or very difficult to manage projects during pandemic restrictions.

The following results show the influence of gender, age, educational level, area of specialization and the researcher's role in the projects on the above variables. As can be seen, the profile of the teacher-researcher is a critical factor in understanding the influence that the pandemic restrictions have had on research work. The first comparisons were carried out with the Mann-Whitney contrast (dichotomous variable). The remaining comparisons were performed using the Kruskal-Wallis comparison test (Table 2).

It can be stated that gender has little influence, so only in the case of the number of papers submitted are the differences between men and women significant, but only at 10% significance. In this case, the results reveal that women claim to have submitted a more significant number of papers than men.

Table 1. Distribution of responses to variables measuring the influence of restrictions on the research process

Variable	Categories	Perc.
Time lost in your research work during pandemic restrictions	Not at all	20.1
	A little	47.0
	Considerably	23.9
	A lot	9.0
What has happened to your research work?	They have been stopped	35.6
	I have looked for alternatives to continue	25.4
	Have switched to COVID approach	5.6
	Other	6.8
	They have continued	26.6
Number of papers submitted	Zero	70.3
	One	20.4
	Two or three	6.7
	Four or more	2.6
Security of project funding	No	63.4
	I am not sure	27.2
	Yes	9.4
Difficulty in project management	Very easy	3.0
	Easy	0.7
	Intermediate	24.9
	Hard	29.4
	Very hard	42.0
Possibility of reformulating the project	No	36.1
	Maybe	37.2
	Yes	26.8

There is also no substantial influence of age except in the number of papers submitted. Looking at the age groups, participants aged 60 years and older report having submitted a more significant number of papers to scientific journals than the rest of their teaching and research colleagues. It may also be due to the more extended research experience of the older teacher-researchers. However, the level of studies does seem to have great importance in the incidence of the restrictions derived from COVID-19 on research work. The time lost during the restrictions is more significant as the educational level of the researcher increases. Thus, it is possible to speak of an increasing relationship. However, the behaviour is the opposite in the number of papers submitted. So, the participants with PhDs claim to have submitted more papers than the rest of the teachers and researchers.

Another critical aspect of the teacher-researcher profile is their area of specialization. There are significant differences in the time lost during the restrictions so that those working in the field of natural sciences claim to have lost more time than those in other areas. Also, the number of papers is submitted. Finally, it should be noted that the role in projects of the teacher-researcher has a significant influence on the time lost and the number of papers submitted. The results show that the principal investigators claim to have lost more time, but they claim to have submitted a higher number of papers.

Table 2. Influence of the profile of the teacher-researcher on the impact of the restrictions on his/her research work. P-values of Mann-Whitney and Kruskal-Wallis tests

	Time lost	Number of papers submitted	Difficulty in project management
Gender	0.897	0.093	0.251
Age	0.228	0.074	0.198
Educational level	<0.001	<0.001	0.159
Area	0.035	0.073	0.968
Role in projects	<0.001	<0.001	0.807

Difficulty in managing research projects has not been considered in this analysis since the results reveal that the influence of the profile is not significant in this case.

Table 3. Canonical weights and multiple fit for the 2-dimensional model

SV	Variable	Weights		MF
		Dim 1	Dim 2	
1	Gender	0.039	-0-002	0.002
	Age	-0.045	0.236	0.058
	Marital status	0.052	-0.570	0.328
	Area	0.026	-0.216	0.048
	Educational level	-0.022	-0.672	0.452
	Role in projects	-0.867	-0.154	0.776
	Employment status	-0.186	0.560	0.348
2	Security of project funding	-0.181	0.562	0.348
	Difficulty in project management	-0.031	-0.158	0.026
	Possibility of reformulating the project	-0.128	-0.307	0.111
	What has happened to your research work?	0.595	-0.053	0.356
	Time lost in your research	-0.363	0.012	0.132
	Number of papers submitted	0.024	-0.710	0.504

Note: SV=Set of variables, MF=Multiple fit

Next, a nonlinear canonical correlation analysis (OVERALS) was performed. For this purpose, two sets of variables were considered. The first one, related to the researcher's profile, included the variables Gender, Age, Marital Status, Employment status, Educational level, Role in research projects

and area of specialization. The second, related to the influence of the pandemic on the research process, which is formed by the variables Time lost in research, number of articles submitted to journals since COVID-19-related restrictions began difficulty in project management, security in project funding, ability to reformulate the project, and situation that has occurred most frequently in their research.

The model with two dimensions best fit with 84.55% (1.691 out of 2) and eigenvalues 0.918 and 0.772 for dimensions 1 and 2, respectively. Thus, dimension 1 explains 54.29% and dimension 2, 45.65% of the total fit. Thus, the canonical correlations are 0.836 and 0.546, respectively.

On the other hand, the canonical weights inform the contribution of the variables to each of these dimensions (Table 3). It can be seen that two variables stand out for their high positive contribution to dimension 1. These variables are the role in projects and what has happened to research after the pandemic outbreak. On the other hand, for the second dimension, the most significant positive contributions come from the number of papers submitted for publication, educational level and marital status; and the negative contributions come from employment status and security of project funding. The poor contribution of the gender of the teacher-researchers to both dimensions also stands out.

Concerning the total fit, the variables with the highest discriminant power are the role in projects, the number of articles submitted for publication and the educational level of the researcher-teacher. Based on the previous weights and the loadings of each component, the correlation coefficients between the set of variables and both dimensions were calculated, resulting in very high values in both cases. It implies shallow simple loss. The results are shown in Table 4.

Table 4. Multiple correlations between sets of variables and dimensions

Multiple correlation	Dimension 1	Dimension 2
Set 1	0.980	0.868
Set 2	0.935	0.842

The analysis of the plot of centroids of the 13 variables included revealed the existence of 4 researcher profiles in terms of the influence of restrictions on the research process:

- The first profile characterizes a woman aged 50 or older from the areas of Social Sciences, Natural Sciences or Computer Science who works full time. She has not encountered great difficulty in managing projects during the pandemic and claims to have almost certainly secured funding.
- Another profile includes a researcher less than 50 years of age in the humanities who claims not to have secured funding for projects and who has difficulty managing them during the pandemic restrictions.
- On the other hand, we also consider the profile of a divorced researcher with a Ph. He or she claims to have modified the research because of the pandemic, which has meant a considerable delay in his or her research output. He also claims to have submitted at least one article for publication to scientific journals during the time analyzed.
- The last profile characterizes a single man or a common-law marriage without a doctoral degree who is not involved in projects. He claims that the pandemic has not affected his research process, but at the same time, he has not submitted any articles for publication during this time.

In short, except for the first of the cases, all participants claim to have encountered obstacles in their research. The obstacles observed are in the management or financing of their research projects or that they have not been able to propose any research paper for publication in a scientific journal.

4. Discussion

The security measures put in place by governments worldwide to slow down the recent COVID-19 pandemic have impacted all areas of people's lives, slowing down or pausing the development of the economy, education, and science. Although a gradual return to normality is expected, some of the effects will be long-lasting in our society. Moreover, just as the reaction to take action was slow, it will also be slow to forget about them.

This paper explores the influence of the pandemic restrictions on the research-related tasks of non-COVID-19 teacher-researchers and their treatment concerning certain variables. These are, among others, the area of knowledge in which the research is carried out, the level of education attained, the professional category in research projects or gender.

Thus, it has been shown that isolation and limitations in circulation have harmed the research of most of the participants. In particular, on the management and funding of research projects. In the latter case, the results align with those obtained by Chernogorova et al. [5], who point to the inability to complete the activities planned in project reports as one of the riskiest factors for project completion.

Although gender does not seem to be a relevant factor in the influence of the pandemic on the development of research work, the only profile that has not encountered difficulties in managing their projects and does not fear losing funding is that of

women aged 50 and overworking in the areas of Social Sciences, Natural Sciences or Computer Science. It may be due to the extensive experience they have acquired in their extensive professional work and that, due to their leadership and prestige, their research projects have not suffered a very severe impact. However, it should be noted that the submission of papers has been delayed as the other participants.

It has also been observed that there are significant differences when considering the area in which the teacher-researchers work. Thus, those working in the science areas claim to have lost much time in the development of their work, which can be explained by the loss of data in studies with animals, plants or carried out in other specialised facilities to which they did not have access during the periods of confinement. On the other hand, it is the projects in the humanities that are not guaranteed to fund, according to the members working on them. It can be explained by the priority given to specific research areas in times of crisis.

5. Conclusions and Implications

The impact of the global pandemic caused by COVID-19 on the world is evident. The isolation measures imposed to increase the social distance to reduce the spread of the virus have affected all areas of life. Moreover, teacher-teachers are no exception to this situation.

Numerous studies have addressed the impact of the global pandemic on the teaching process [10]. However, there are almost no studies that address the other area of work of university teachers: such as research.

When the goal was to stop the transmission of the virus and find possible treatments for fighting it, research directed toward these goals increased thanks to different specialists' work exponentially. It allowed treatments to be achieved in a short time.

However, other research suffered many difficulties that were reflected in the abandonment of field studies, the paralysis or slowing down of research projects and a decrease in scientific production.

This research work is based on the assumption that the personal and work profile of the teacher-researcher can be a determining factor in the influence of the pandemic context on their research work. Therefore, the main objective of this study is to test the validity of this assumption.

As can be seen from the results obtained, aspects such as the level of education, the area of specialization of the research and the role played in the execution of the projects are variables that influence the research process. Personal aspects such as age or gender also show such influence to a lesser extent. Therefore, the assumption on which the research work was based is confirmed.

From the above, it can be concluded that the influence of these constraints on research work is not the same for all researchers. Both personal and work profiles play an essential role in the consequences of the pandemic.

The results of this study will help future research work to make decisions on the measures to be taken to alleviate the low performance of research by teacher-researchers during this period and to prepare contingency plans to reduce the impact on such a critical area as science in similar situations that may arise in the future. The effectiveness of these measures will be greater if the heterogeneity detected in this work is taken into account.

Measures such as making the possibility of reformulating projects and their economic management more flexible, or paying particular attention to the difficulties experienced by young research staff in order to try to mitigate them, could help to reduce the impact that these situations have on research work. Also, customized planning for each research area would help address the specific problems that each has experienced during the pandemic.

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