Multidisciplinary Journal of Management, Economics, and Accounting
ISSN: 2705-2842
Number 4 Issue 1 2018

Total Productivity Of University Professors: Labor Policies Influence Of Teleworking

Olivia Jensen
University of Melbourne, Australia

Abstract

Academic productivity as an expression of quality, is a latent, complex, and dynamic variable, which represents a challenge for the substantive functions of research and teaching at the higher level. Thus, this article aims to analyze the dynamics of the influence of Colombian remote work labor policies on the productivity of higher education teachers. Based on a mixed methodology, dynamic hypotheses were formulated through a causal loop diagram and scenarios were simulated with a stock and flow diagram of Systems Dynamics from a perspective of long-term productivity. The global analysis of the simulations showed that there is an increase in the total productivity of the teaching staff when the hours of supplementary teleworking in research are increased. There is no evidence of sensitivity in teaching productivity to the hybridization of subjects. Considering the analysis carried out here, it will be realized that, in the future, both public and private policies, as well as decisions aimed at increasing the academic productivity of higher-level professors, broadly contemplate elements of well-being, in addition to the estimation of all the tasks and products in charge of the teaching staff.

Keywords: higher education; labor policy; professor; productivity; simulation models.

1. Introduction

In the private policies of each Higher Education Institution (HEI), alternatives are presented for the teaching and learning processes that range from scenarios of total presence, total synchrony in remote, alternation, inverted classroom, hy-flex (includes hybridization synchronous and simultaneity in classrooms), playlists, even synchrony-asynchrony (García, 2021); all in favor of improving its quality as it develops competencies in teachers in knowledge, attitudes and skills for the orientation of classes outside the traditional classroom, didactics, the use of technology, the approach of effective situations in face-to-face contexts, hybridization and virtuality (Martínez et al., 2022). These alternatives allow, among others, to consider multiple nuances for the teaching of classes according to the undergraduate or postgraduate level at which they are directed, the presence in regions, the technological tools, the dedication of the teachers to the preparation of the classes, the adaptation of contents and teaching tasks simultaneous to face-to-face and non-face-to-face teaching such as research, management, updating of teaching and research skills - creation and extension or social projection (Barragán, 2020).

Although public educational policies have an influence on the quality of teaching staff, the holistic observation of each member of the higher-level teaching staff is essential, since their activities go beyond teaching and are limited to the contractual relationship with the institution (Cosenz , 2014; Barragán and Guzmán, 2022; González et al., 1989). In other words, the combination of educational and labor public policies influence the quality of the teaching staff, since this is not alien to the typology in hiring, high turnover and the conditions that favor or affect the work environment (Chirinos and Padrón, 2010 ; Monterrey Technological Observatory, 2022; Rørstad and Aksnes, 2015).

Additionally, the institutional context in which teachers' activities are carried out also influences their quality, in relation to the magnitude of the gap in the implementation of public educational and labor policies (Hernández et al., 2013; Ballestas and Rivera, 2009). In addition, spaces, media, technologies and strategies were tested during the COVID-19 pandemic, due to the emergency and to continue providing the educational service (Albor et al., 2020; García, 2021; Díaz et al. ., 2020).

Figure 1 summarizes the educational alternatives, competencies and activities to be developed by the teaching staff of an HEI within the framework of public educational policies and institutional policies that define the mission, vision and learning outcomes (Tshai et al. al., 2014; Universidad del Desarrollo. Center for Teaching Development, 2018; Ministry of National Education, 2020) with which it has been committed.

As mentioned, in addition to public educational policies, there are others that concern HEIs in their organizational structure and processes (Cosenz, 2014). The labor relations of teachers, administrators and managers are subject to international commitments, provisions, laws, treaties and current regulations in general and specifically in the educational sector (International Labor Organization, 1986, 2020; Hernández et al., 2013; Chirinos and Padrón, 2010; García-Cepero, 2010; Cosenz, 2013; World Bank, 2021).

Figure 1. Educational alternatives, competencies and activities of university professors.

Source: Own elaboration based on García (2021) and Martínez et al., (2022).

As available relationship options between employees (teachers) and employer (IES) that can increase total productivity while reducing work stress, we can list:

remote work, the four-day work week (compressed week) implemented in Iceland, Japan, New Zealand and Spain (Observatorio Tecnológico de Monterrey, 2022; Christian, 2022) and as the right to digital disconnection from observation in Spain, Colombia and Portugal (Head of State of Spain, 2018; Congress of Colombia, 2022; Assembleia da República Portugal, 2021).

This entire context generates the research question: How do Colombian labor policies regarding remote work influence the total productivity of higher education teachers? Accordingly, the objective of this article is to analyze the dynamics of the influence of labor policies. Colombian distance work in the total productivity of higher education teachers.

To achieve the objective, this article is presented in five sections. Following this introduction, a section corresponding to the referential framework was included to delimit the concept of distance work in its different modalities and the total productivity of higher-level teachers as a latent variable. Next, in another section the research methodology was established. Later, the results obtained with the implementation of this methodology were included. Also, a section for discussion of results and conclusions was incorporated.

2. **Reference framework**

To connect the quality of teaching staff with their total productivity, it is necessary to define the concept of remote work and its modalities, as well as the latent variable called total productivity of higher-level teachers. This, together with the technological skills required for teachers to assume the new challenges imposed by changes in the way they work; and they are points under the consideration that the analysis of the dynamics of the influence of Colombian remote work labor policies

on the total productivity of higher education teachers requires the identification of distinctive attributes.

2.1 Remote work modalities in Colombia

In terms of modalities, in addition to the traditional face-to-face work at the facilities and with the resources designated by the employer, there are those of remote work, contemplated in Colombian legislation: teleworking, work at home and remote work (Figure 2). In response to the needs of the environment and leveraging the advancement of companies' digitalization processes, the regulatory progress in this matter stands out, which has allowed companies to continue their activities, thereby preserving jobs at the same time. while prioritizing the health and well-being of employees.

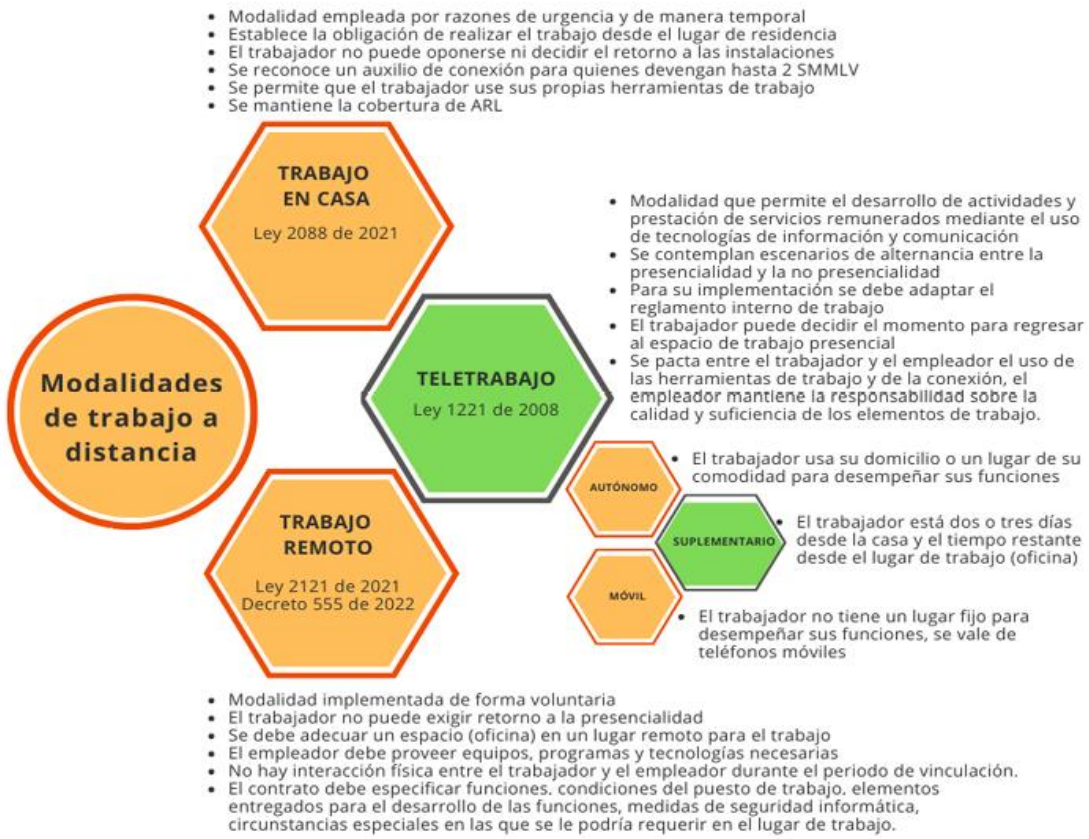

Figure 2. Remote work modalities

Source: Own elaboration based on Díaz (2022) and Congress of Colombia (2021, 2008).

Although remote work modalities share some elements such as compliance with the maximum legal working day, occupational risk coverage, types and forms of contracting and the right to rest and disconnection, they particularly differ in the commitments to attend to facilities and in the use of the resources necessary to carry out the work.

These employment alternatives promise advantages, among which are mentioned:

1. Reduction of stress generated by the times and conditions of travel between residence and workplace.

2. Respect for the worker's autonomy in terms of time management.

3. More inclusive jobs that meet the needs of vulnerable populations.

4. Better mental health.

5. Friendly physical environment.

6. Varied social environment that may or may not include coworkers or that may facilitate socialization with location colleagues, but not from the same company or job.

7. Different hierarchical environment since it may or may not have the physical presence of superiors or subordinates.

It is important to recognize that there are also opposing versions of the advantages just listed, including “teleworking, in general, can lead to longer working hours and an increased workload during nights and evenings.” weekends” (International

Labor Organization, 2020, p. 5), contact during non-working hours in non-emergency situations and workers in precarious situations who do not have a work schedule (Ramiro, 2021).

Particularly, during the COVID-19 situation, for university professors with full-time dedication to HEIs, working at home was implemented as an emerging strategy, given its characteristics of temporality and use in extraordinary cases. However, for the purposes of this study, it was seen that the modality that most closely approximates the new work reality of university professors is related to teleworking, and to that extent it is advisable to review the particularities established by law in order to guarantee quality. of work and productivity. For the International Labor Organization (ILO), teleworking is defined as

[…] the use of information and communications technologies – such as smartphones, tablets, laptops and desktop computers – to work outside the employer's premises. In other words, teleworking entails work carried out with the help of ICT [1], outside the employer's premises (International Labor Organization, 2020, p. 1).

In Colombia, teleworking was the first of the remote work modalities regulated and defined in Article 2 of Law 1221 of 2008 as:

A form of labor organization, which consists of the performance of paid activities or provision of services to third parties using ICT as support for contact between the worker and the company, without requiring the physical presence of the worker at a specific work site (Congress of Colombia, 2008).

In this modality, all conditions must be made explicit in the internal work regulations, allowing the combination between presence and non-presence, being the conditions of time and type of resources, or elements to carry out the work,

matters that can be modify during the employment relationship. Although the worker has autonomy in the use of resources, these remain under the responsibility of the employer (Congreso de Colombia, 2008). In a complementary manner, types of teleworking have been regulated: autonomous, mobile and supplementary, this last category being the one that best fits the activities of the teaching staff, since this modality allows the work to be carried out for two or three days from home and the other days attending the facilities to attend face-to-face classes, tutorials, laboratories and other tasks that require institutional physical resources for their correct functioning.

However, any work modality considered must be closely related to the fulfillment of the missionary activities of the HEIs (teaching, research and social projection) and with the total productivity of teachers (Congress of Colombia, 1992; García-Cepero, 2010 ; González et al., 1989; Cosenz, 2014).

2.2 Total productivity of higher level teachers

The concept of productivity has evolved rapidly in recent years, however, there are still no definitive agreements, since from the conceptualization and regulations there are no conclusive elements that lead to valuing it equitably among HEIs, much less among countries or regions. As an illustration, productivity can be understood as the interaction between research and dissemination (Maletta, 2016) or as Gordillo et al. warn. (2020), total productivity is affected by the multidimensionality of the activities of university professors, where these activities compete for economic resources, time, and efforts dedicated in relation to the products obtained.

Given that university professors cannot be seen as workers in a mass production system, Rhoades (2001) stated that actions aimed at improving their total

productivity cannot obey individual strategies but rather the ability to encourage work in teams of varied levels and disciplines. This author suggests a productivity management model based on principles that he groups into four dimensions corresponding to the questions Whose productivity? Productivity for which unit of analysis? Productivity according to what functions? Productivity for whose interests? In this same sense, Montero et al. (2013) affirm that one of the ways to promote total productivity is related to collective work between teachers, a collaboration that goes beyond co-authorship and joint research and that favors dialogue aimed at the organization of work, the development professional and, finally, the possibility of generating ideas, projects, solutions and contributions for scientific advancement.

According to Velásquez et al. (2012) the most appropriate way to refer to the factors that affect total productivity is the one that divides it into internal factors and external factors. Internal factors are those over which the organization (in this case the IES) has control and can incorporate the necessary adjustments aimed at increasing total productivity, since it exercises its autonomy regarding economic, human and technological resources. External factors are beyond the reach of the organization, as they refer to governmental and environmental matters. The need to establish clear public policies in this matter is highlighted, then, given that the effectiveness or efficiency in implementation depends largely on the aforementioned clarity.

Given the internationally conceived forms of measurement, productivity is seen exclusively in relation to teaching and research activities, leaving aside those other functions that are essential to meet other requirements of the future of HEIs. In that sense, it is essential to visualize total productivity

[…] as a latent variable, implies assuming that the products that are used as indicators of it, are only a sample of the possible observable indicators of it, this is how production is not the indicators in themselves, but a phenomenon that underlies them. In other words, products are an emergent property of said latent variable (García-Cepero, 2010, p. 16).

In the same sense, talking about productivity in the academic environment becomes complex due to its direct relationship with industry and the economy. It is advisable to reflect on those elements that allow setting appropriate performance and efficiency goals, referring to the skills and abilities developed. by the community, based on a determined investment to produce improvement in human resources and great value and social contribution. As analyzed by Montero et al. (2013), these essential functions of knowledge transmission (teaching) and knowledge generation (research) are perceived as potential sources to generate economic profits, which supports HEIs valuing their academics based on the commercial value of the intellectual material they provide. produce and with it their ability to generate income.

It should be noted that HEIs, according to their autonomy and their understanding of efficiency, have different parameters based on products for measuring and valuing total productivity (Rørstad and Aksnes, 2015), however, Table 1 shows appreciate the main products related to research and teaching activities, other categories of activities have also been included, considering them important, since they serve as drivers of performance and, in the long term, grant prestige and recognition to the HEIs in the education market (Bisschoff and Asvat, 2019). It is highlighted that the dedication of full-time university professors implies a contractual responsibility towards all the products in Table 1, while the dedication

of teaching hours is related only to direct teaching, that is, the teaching of subjects in the time provided in the study plans without including, for example, support in extra-class time.

Regarding remuneration or economic reward in relation to total productivity, various policies have been adopted worldwide aimed at encouraging production, mainly in research, with a view to increasing visibility and scientific competitiveness and thus increasing the prestige of IES, this is a component that requires further study. In Colombia, the recognition of total productivity within the salary and benefits regime of teachers at official universities was established by the Ministry of National Education (MEN) as salary points (Ministry of National Education, 2002). In the case of private universities, total productivity leads to recognition and incentives of another nature (generally not constitutive of salary or as forms of the so-called emotional salary) defined by administrative bodies through institutional policies. In a complementary way, some products in Table 1 are added to other inputs that the HEIs take into account to measure the total productivity of the teaching staff, such as the measurements and categorizations entailed by the National System of Science and Technology (Ministry of Science , Technology and Innovation, 2021). In addition to the factors on teacher remuneration, other aspects of the work environment are added, which also affect their motivation and total productivity.

Table 1. Products and variables associated with the activities of full-time university professors.

Investigation	P restige and
Production of scientific articles (submitted and	recognition of the

published)	IES
Books and book chapters derived from research (submitted and published)	
Conferences/Papers presented to the academic community	
Number of projects approved with internal financing	
Number of projects approved with external financing	
Number of patents (copyright registrations on works)	
Teaching	
Results of student perception or evaluation surveys	
Rates of approval, failure, loss due to non-attendance, withdrawal of subjects	
Number of students served in tutoring, counseling and mentoring	
Number of students directed in degree work	
Training	
Activities for professional reconversion	
Training courses in the use of ICT for education	
Design and management of technology-mediated	

learning environments
Extension and Social Projection
Cooperation and interaction with the national and international academic community
Visibility and continuous training activities, training for life
Administration
Activities associated with education quality assurance processes

Source: Own elaboration based on Barragán (2020).

2.3 Teaching skills in technologies and their relationship with hybridization

In the context of remote work in the form of supplementary teleworking, teaching activity under hybridization schemes becomes relevant. This requires that teachers be sufficiently trained and aware of the implications of each of these schemes and the appropriate management of technology-mediated learning environments; Furthermore , HEIs must adjust their pedagogical models and provide the necessary resources to maintain educational quality standards under the new schemes. In other words, in response to macrosocial processes, Information and Communication Technologies (ICT) fell short and gave way to

[...] the so-called learning and knowledge technologies (TAC), specifically aimed at educational realities, by understanding local needs in global contexts, in such a way that the educational field had a series of tools that allowed it to innovate in a new meaning, expand coverage and bring to students what was forbidden to them

for a long time. Such transformations could only be fully accomplished if they were linked to political processes and special programs for citizen education, which is why empowerment and participation technologies (TEP) were a contribution to the way in which ICTs and ICTs should be understood and applied. TAC to specific environments and problems (Latorre et al., 2018, page 14).

As Ballestas and Rivera (2009) state, interactivity, as a communicative and pedagogical process, represents a greater challenge, a challenge fundamentally marked by the way in which this pedagogical proposal is presented. Hybridization, which involves a distribution of times and activities between the face-to-face and virtual components for teaching and learning, requires special forms of interaction in virtual settings (Latorre et al., 2018). To act accordingly, the implementation and execution of such processes must be redefined, with appropriate and functional content for interaction, which guarantees real learning, which promotes collaborative work while energizing classes with the permanent use of multiple and varied virtual tools largely available for free.

In this sense, some previous studies refer to the existence of three basic elements that must be integrated into the knowledge acquisition process: Content Knowledge (CK), referring to knowledge about the specific subject that is to be taught; Pedagogical Knowledge (PK), related to the discernment of the pedagogy necessary for students to achieve said contents; and, Technology Knowledge (TK), related to knowledge of technology that favors the learning process (Acevedo et al., 2021). Based on these three interrelated basic components, they formulated the TPACK model to refer to the appropriate integration of ICT into the teaching and learning process in order to achieve the intended learning outcomes, while allowing the concept and use of ICT to evolve. , whenever technology is used to

support comprehensive education, and to promote academic, political, cultural and social participation using the tools that the digital era allows (Ariza, 2019).

3. **Methodology**

The research methodology implemented to achieve the research objective was of applied purpose and mixed approach, composed of three phases:

Phase 1: Survey of public labor policies for remote work closely related to the activity of university professors with full-time dedication and teaching hours. Although these policies had already advanced internationally, the confinement and post-confinement due to the COVID-19 pandemic served as a catalyst based on the experience in presence, telepresence, hybridization and virtuality.

Phase 2: Formulation of dynamic hypotheses to identify the role of each element in the total productivity system of full-time teachers in the context of remote work. Causality was analyzed using a causal loop diagram typical of system dynamics incorporated to express the structure of the system and its behavior over time (Aracil and Gordillo, 1997; Bala et al., 2017). Dynamic hypotheses are made explicit in the results when the feedback loops that reveal the structure of the system are described.

Phase 3: Modeling and simulation using a Stock and Flow diagram of system dynamics to analyze the behavior of long-term teaching productivity (Barragán and Guzmán, 2022; Barragán, 2020). The parameterization of this model was carried out considering the historical labor information in Colombia (Congreso de Colombia, 2021, 2008).

4. **Results**

Circumscribed to the scope of the higher educational level in Colombia, supplementary teleworking for teachers is understood as the proper development of teaching and research activities, distributing a part of the weekly workload from home and the rest of the weekly work day (in hours) from the IES facilities. For its part, the hybridization of subjects is understood as the distribution of the total hours of the teaching staff's workload dedicated to direct teaching divided between presence and distance (García, 2021). Below are two simplified examples of the distribution of university teaching activities in light of teleworking and hybridization, over a weekly workload of 45 hours:

First example. In a teaching profile accentuated in research, of the complete weekly workload, 12 hours (26.7%) are allocated to teaching. For its part, 29 hours (64.4%) are dedicated to research and 4 hours (8.9%) to training, social projection and administration, together. The teaching hours can be distributed in 8 hours taught in remote telepresence for theoretical classes and 4 in person for activities with students and for tutorials, while the research hours can be distributed in 19 hours of experimentation in laboratories or workshops located in the facilities of the IES and in 10 hours for data processing, writing reports and writing articles. This example suggests an approximate distribution of 40% (2 days of 9 hours) of the workload in supplementary teleworking and 60% (3 days of 9 hours) in person at the IES facilities.

Second example. Again in a teaching profile with an emphasis on research, 12 hours (26.7%) are allocated to teaching. For its part, 29 hours (64.4%) are dedicated to research and 4 hours (8.9%) to training, social projection and administration, together. The teaching hours are distributed the same as in the first example, but the research hours do not require time in laboratories or workshops,

but are based on desktop testing or software development. This suggests an approximate distribution of 82.2% (4 days of ٩ hours) of the workload in supplementary teleworking and 17.8% (1 day of 9 hours) in person.

In this distribution of individual teachers' time, the products in Table 1 are built and designed consistent with the training and emphasis of the profile in teaching, research or administration (e.g. when there are assignments for directing academic programs). The institutional weighting of the accumulation of these individual products (teaching and research-creation products) shapes the total production (Barragán, 2020). Additionally, in the research preliminary projects, the expected products are formulated, which translates into research goals or desired production to meet the committed execution times. For its part, in the strategic plans, improvement plans and in self-evaluation processes for high quality accreditation purposes, production goals are stipulated in terms of teaching, that is, in an expected productivity in teaching.

Based on the examples and the consideration of total productivity, Phase 2 was implemented , the causal loop diagram in Figure 3 was constructed to formulate the dynamic hypotheses that represent the influences of the elements of the total productivity system. and feedback structures. This diagram shows that the IES detects a discrepancy between the desired total productivity and the current total for its teachers, without having changed its total production goal for teachers; In other words, the IES discovers that the total production of teachers decreases. Possibilities such as assigning additional teleworking to teachers and hybridizing subjects are included as corrective actions in this diagram.

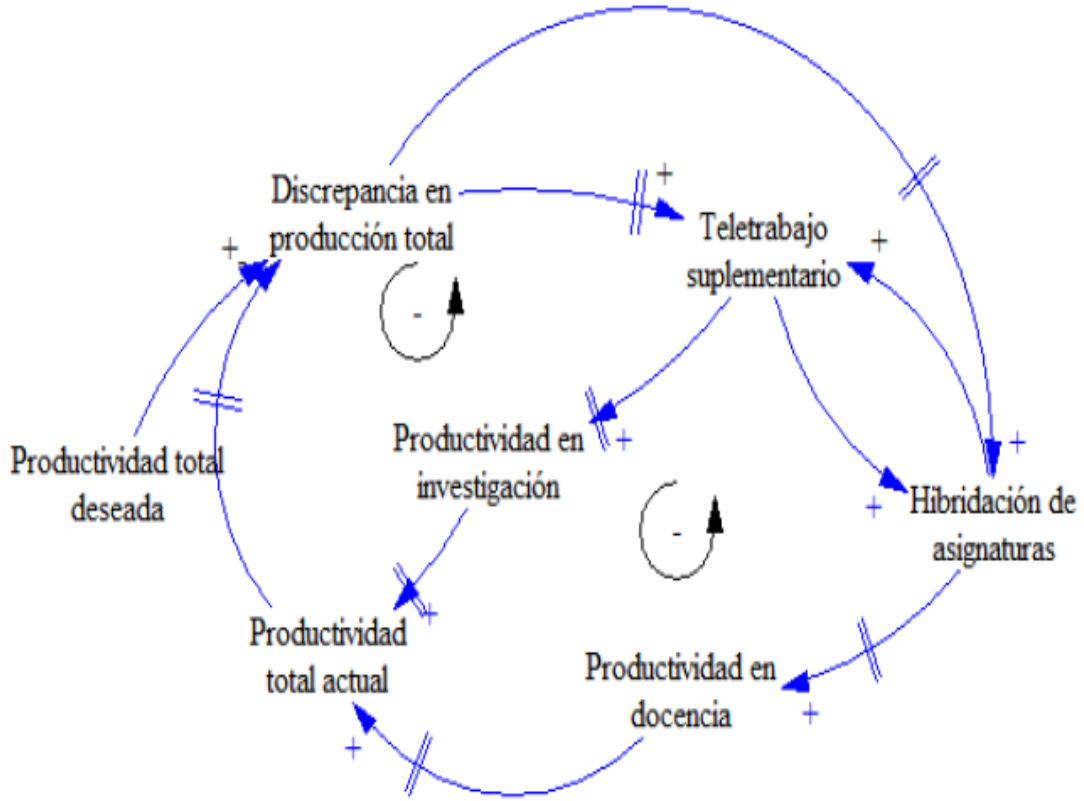

Figure 3. Causal loop diagram for analysis of the role of the elements in the system.

Source: self made

Below, some feedback loops are described given that they indicate the behavior of the total productivity system of teachers, which are part of the dynamic hypotheses for the system under analysis:

B1: A greater number of hours in supplementary teleworking means a greater number of hours in hybridization of subjects, which improves productivity in teaching based on flexible teaching and learning processes (García, 2021) and consequently the current total productivity as well. increases, reducing the

discrepancy with the desired production. If the discrepancy increases, the institutional effort in supplementary teleworking increases.

B2: A greater number of hours of the weekly workload carried out in supplementary teleworking means less travel by public or private transport, less stress and work fatigue, which improves research productivity and therefore current total productivity. This increase in current total productivity decreases the discrepancy with expected total production. If the discrepancy decreases, there can be organizational relaxation in the search for integrated and flexible solutions, reducing the hybridization of subjects so that students and teachers attend physical classrooms in the same space simultaneously. Simultaneous attendance in the current circumstances may be affected and without other alternatives may mean the interruption of operational continuity in the event of an unforeseen event (International Labor Organization, 2020).

Figure 4 presents the Stock and Flow Diagram for the total productivity of teachers considering the time allocated to supplementary teleworking and direct teaching in hybridization. Direct teaching corresponds to class hours with students (not class preparation or evaluation grading), that is, it is the time of direct exchange with students and hybridization corresponds to the times in which these exchanges occur mediated by technology in telepresence, distance or virtuality. It should be noted that the weekly workload of teachers (parameterized in this model as 45 hours) corresponds to the sum of the time allocated to supplementary teleworking and direct teaching in hybridization and other activities.

Multidisciplinary Journal
of Management, Economics, and Accounting
ISSN: 2705-2842
Number 4 Issue 1 2018

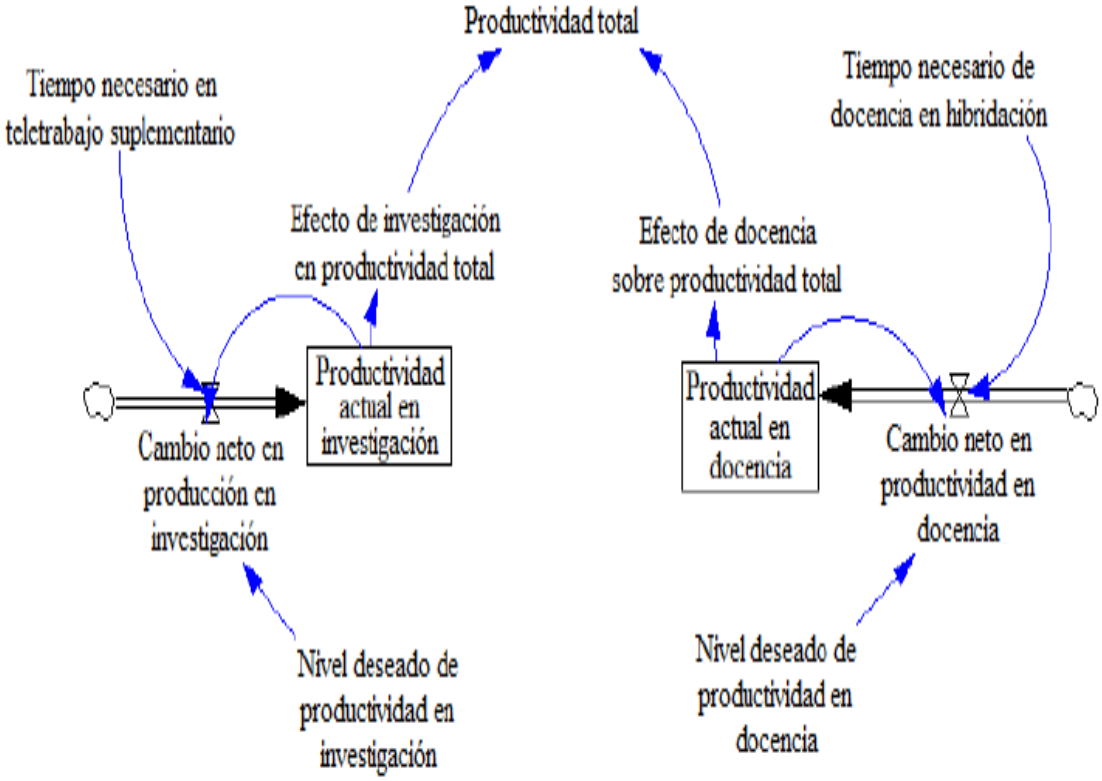

Figure 4. Stock and Flow diagram for total teacher productivity.

Source: self made

Based on the model in Figure 4, scenarios for the dynamics of total productivity (simulations) were explored. In the development of Phase 3, the simulations were carried out considering the week as a time unit and a final time equivalent to 260 weeks (approximately five work years of 52 weeks each, given that the academic periods are 16 weeks in average and fixed-term contracts for one year consider 52 weeks). The scenarios analyzed were framed in:

SIM1: Reference mode in which it is observed based on the initial parameters in Table 2.

SIM2 to SIM5: Modification of the percentage of workload hours of the time needed in supplementary work.

SIM6 to SIM9: Modification of the percentage of workload hours of the necessary teaching time in hybridization.

Table 2 summarizes the variables in the diagram in Figure 4, their equations, their units of measurement and the observations for those that require it. It is essential to remember that, in the workload of teachers, activities compete for time, that is, the times dedicated to teaching, research, management, updating and administration activities are always draining each other; For example, if a lot of time is invested in research, it must be spent on other activities.

Table 2. Description of the variables present in the system for the total productivity of teachers.

Variable	Equation that defines it	Units	Observation
Net change in research output		Publications/Week	
Net change in teaching productivity		Students/Week	
Effect of teaching on		dimensionless	Total productivity is made up of that coming from

Variable	Equation that defines it	Units	Observation
total productivity			teaching, research and other activities.
Effect of research on total productivity		dimensionless	
END TIME	260	Week	
INITIAL TIME	0	Week	
Desired level of productivity in teaching	0.58	Students [0,1]	They can range between 0 and 1 depending on the assignment and the profile of the teachers. In addition, total productivity is made up of that coming from teaching, research and other activities.
Desired level of research productivity	0.25	Publications [0,1]	
Current productivity in teaching		Students	

Variable	Equation that defines it	Units	Observation
Current research productivity		Publications	
Total productivity		dimensionless	
Necessary teaching time in hybridization		Week [0.0.355]	Teaching time was parameterized in a range equivalent to a maximum of 16 hours and teleworking time was set to a maximum of 19 hours over a workload of 45 hours per week. These two missionary activities compete in time with each other and with the other activities assigned to teachers.
Time needed for additional teleworking		Week [0.0.4222]	
TIME STEP	1	Week	

Source: self made.

Figure 5 corresponds to the first SIM1 scenario in which the behavior of total productivity is explored according to the parameters stipulated in Table 2. This simulation shows a final asymptotic behavior for the aforementioned total productivity approximately 0.463001.

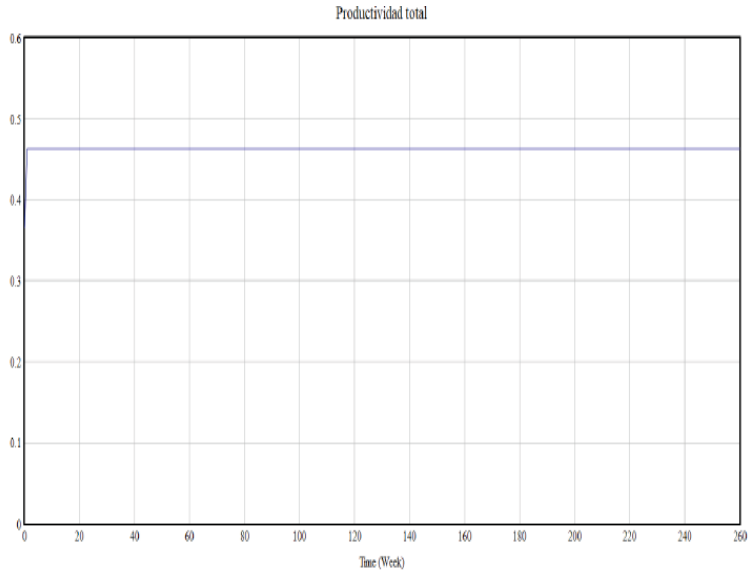

Figure 5. Total productivity of teachers-reference mode.

Source: self made.

The exploration of the behavior of SIM2 total productivity is shown in Table 3 in terms of the modification of the necessary supplementary teleworking time. These three simulations were done under Ceteris Paribus, which implies that the necessary teaching time in hybridization is . It was observed that the longer the time spent teleworking, the greater the total productivity.

Table 3. SIM2 to SIM5 – Changes in hours in supplementary teleworking.

Simulation	Percentage of workload in supplementary teleworking	Asymptote for the total production of teachers
SIM2	20.58%	0.444658

SIM3	38.00%	0.471682
SIM4	40.11%	0.476026
SIM5	42.22%	0.480687

Source: self made.

The simulations and their respective percentages of the teaching workload in hybridization were: SIM6-14.2%, SIM7-20.86%, SIM8-31.06% and SIM9-35.5%. As before, these simulations are governed by Ceteris Paribus, which is how the necessary teleworking time is. Here the low or no sensitivity of total production to changes in hybridization percentages is revealed, since in the four simulations the asymptote for the total production of the teachers was 0.463001.

Figure 6 shows the results of the simulations at 260 weeks, graphically representing the long-term trend of teachers' total productivity in the presence of changes in workload hours in supplementary teleworking and in hybrid teaching. As total productivity rests mostly on products as a result of research or scientific writing processes, long-term behavior is affected by the increase or decrease over time in the workload.

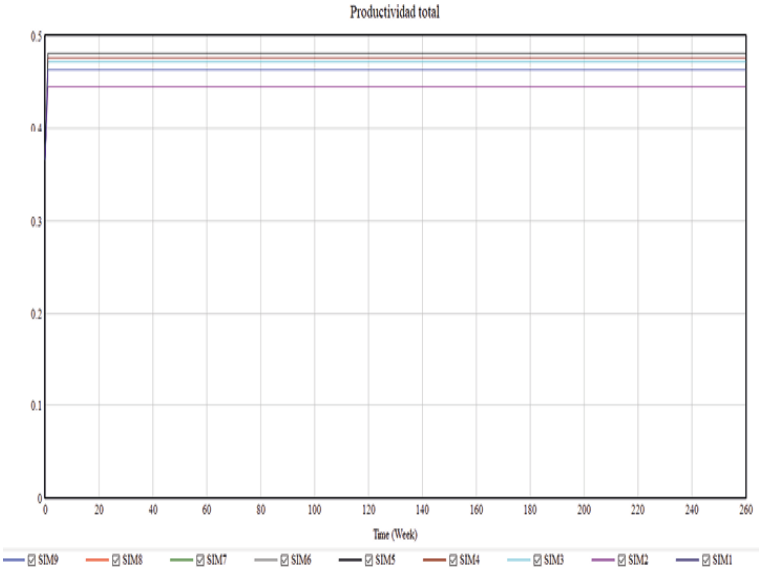

Figure 6. Simulations for total teacher productivity.

Source: self made.

5. **Discussion and conclusions**

The mathematical modeling suggested in this work, analyzing the dynamics of the influence of Colombian remote work labor policies on the total productivity of higher education teachers, was based on incorporating the changes demanded from labor policies due to teleworking and the consequent hybridization of teaching, the model includes the variations for research and teaching as substantive and objectively measurable functions, without ignoring that the other activities assumed by teachers (extension and social projection, training and administration) compete in time and dedication, and also require specific products as part of the dynamics of the HEIs, mainly in the quality assurance processes and in their own economic sustainability.

The proposed model generalizes the institutional behavior of total productivity in the face of the implementation of labor policies on supplementary teleworking and changes in research and teaching variables with hybridization.

To achieve a more precise measurement of total productivity, the reasonable differences that may exist for each disciplinary area should be considered, among others, the characterization of the teaching staff, the type of university institution, the geographical location and trajectory, mainly should be included in the analysis the declaration of having an institutional educational project focused on teaching or research and the resources available to achieve this purpose. A complementary element of this view of total productivity is that the greater weighting of research production can result in the removal of the best professors from teaching (the most qualified and experienced), added to the fact that the results of research do not always research have a direct impact on the curriculum, it can be detrimental to the training responsibility that underlies the spirit of the HEIs.

The analysis of the relationship between total productivity and research quality can be understood as resolved from the perspective of each HEI since production is submitted to the evaluation and arbitration of each publication and scientific event. For its part, in teaching, said analysis would imply turning to the variables related to the time dedicated and the (intangible) products that are derived from the academic discussion between peers, the times of preparation, application, validation, verification and improvement of the required educational materials that there is no way to standardize and that must be different if teaching is supposed to be face-to-face, virtual or hybrid.

Differentiating profiles of university professors could contribute to improving total productivity; those with a greater profile towards teaching can enhance their work by identifying inputs and products directly related to teaching activity. And those with a greater profile towards research will have to dedicate their time to obtaining products with high visibility and weighting by the academic community.

The learning acquired during the pandemic made it possible for organizations, and in particular HEIs, to assume the alternation between in-person and teleworking as a plausible option to increase the total productivity of teachers and in general of all university levels. A high percentage of workers do not wants to return to the rigidity of schedules and forms of work of the pre-pandemic era, since the progress achieved in total productivity and quality of life is valued even in the uncertainty due to the social and economic provisions at the governmental and managerial level of the organizations. .

Likewise, it should be considered that HEIs, in recent times, have invested resources to strengthen their ICT infrastructure, particularly for the requirements of spaces that favor the hybridization of subjects, which requires strengthening the skills of teachers to optimize these resources, and a migration of HEIs that transcend their pedagogical models towards the inclusion of alternating academic modalities. These elements must lead to improved productivity in teaching.

Although the simulations showed an increase in total productivity when the hours of supplementary teleworking increase, it is vitally important that decisions on total productivity are accompanied by plans to improve the mental and physical health of teachers, with special observation of the stress and work fatigue as well as burnout syndrome, this in response to the ILO (2020) warning that research on teleworking has repeatedly provided evidence that those who work from home work more hours than when they are working at the employer's premises, as travel time to the workplace and changes in work routines blur the fine lines between paid work time and personal time.

Future research can delve into the complexity of the latent variable of total productivity of university teaching staff until reaching agreements on public and

private policy, about the common elements to be taken into consideration for its objective measurement in light of the reality of the times. required and the expected products in the other functions in charge of the teaching staff as a vital element for the dynamics of the HEIs.

References

Acevedo, Á., González, R., González, C. and Sánchez, L. (2021). Teleworking as an emerging strategy in university education in times of pandemic. Journal of Social Sciences, XXVII(3), 460-476. Recovered from https://bit.ly/3yrT9Wj

Albor, L., Filut, D., Valero, B. and Rodríguez, K. (2020). Proposal for a pedagogical innovation model to reduce school dropouts in Colombia from the experience of Israel. Igarapé, 12(4), 120-145. Obtained from https://periodicos.unir.br/index.php/igarape/article/view/5420

Aracil, J. and Gordillo, F. (1997). Dynamic of systems. Madrid: Editorial Alliance.

Ariza, C. (2019). ICT and TAC within education for social communicators and journalists: the new challenge of the professional profile. Obtained from Digital Humanities, dialogue of knowledge and collaborative online practices - UNESCO Chair in Communication. https://bit.ly/3asXP6r

Assembleia da República Portugal. (December 6, 2021). Law No. 83/2021 modifies the teleworking regime, altering the Work Code in Law No. 98/2009. Diário da República n.º 235/2021, Series I of 2021-12-06. Retrieved from https://bit.ly/3bTWPbL

Bala, B.K., Arshad, FM, and Noh, K.M. (2017). System Dynamics Modeling and Simulation. Springer.

Ballestas, N. and Rivera, P. (2009). Technological hybridization, An approach to the communication process from the educational perspective. Panorama, 7, 21-27. Retrieved from https://bit.ly/3NSODWC

Barragán, S. (2020). University professors: a human resource that requires maturation. Perspective from system dynamics. In E. and. Education Research Network, Education, business and society from a transdisciplinary perspective (pp. 397-420). Bucaramanga: EIDEC. https://doi.org/10.34893/z3ey-d407

Barragán, S. and Guzmán, A. (2022). Difference in academic-scientific productivity from a gender perspective after COVID-19 using a simulation model. Sociology and Technoscience, 12(1), 93-111. https://doi.org/ 10.24197/st.1.2022.93-111

Bisschoff, C. and Asvat, R. (2019). Developing a Conceptual Model to Measure Business Performance for Private Higher Education Institutions. International Journal Management in Education, 13(4), 307-337. https://doi.org/10.1504/IJMIE.2019.102581

Chirinos, N. and Padrón, E. (2010). Teaching efficiency in educational practice. Journal of Social Sciences, XVI(3), 481-492. Retrieved from https://bit.ly/2ZY1y4h

Christian, A. (March 22, 2022). The realities of the four-day workweek. Retrieved from https://bbc.in/3uvznYH

Congress of Colombia. (December 28, 1992). Law 30 of 1992. By which the public service of Higher Education is organized. Retrieved from https://bit.ly/3Ph5qUv

Congress of Colombia. (July 16, 2008). Law 1221 of 2008. By which rules are established to promote and regulate Teleworking and other provisions are dictated. Official Gazette No. 47,052. Retrieved from https://bit.ly/3ySbX2t

Congress of Colombia. (May 12, 2021). Law 2088 of 2021. By which working at home is regulated and other provisions are dictated. Official Gazette No. 51,672. Retrieved from https://bit.ly/3c0IFWu

Congress of Colombia. (August 3, 2021). Law 2121 of 2021. Through which the remote work regime is created and rules are established to promote, regulate it and other provisions are dictated. Official Gazette No. 51,755. Retrieved from https://bit.ly/3RlzEar

Congress of Colombia. (January 6, 2022). Law 2191 of 2022 By means of which labor disconnection is regulated - Labor Disconnection Law. Official Gazette No. 51,909. Retrieved from https://bit.ly/3ABxmOv

Cosenz, F. (2013). The "entrepreneurial university": a preliminary analysis of the main managerial and organizational features towards the design of planning & control systems in European academic institutions. Management Research and Practice, 5(2), 19-36. Recovered from https://bit.ly/3AxUUnt

Cosenz, F. (2014). A dynamic viewpoint to design performance management systems in academic institutions: theory and practice. International journal of public administration, 37, 955-969. https://doi.org/10.1080/01900692.2014.952824

Díaz, A., Bravo, C. and Sierra, G. (2020). Inclusive education in context: reflections on the implementation of Decree 1421 of 2017. Revista Historia de la Educación Latinoamericana, 22(34), 265-290.

Díaz, S. (April 14, 2022). Learn about the main differences between remote work modalities. The Republic. Retrieved from https://bit.ly/3nQrNnQ

García, L. (2021). COVID-19 and digital distance education: pre-confinement, confinement and post-confinement. ITEN, 24(1), 1-18. https://doi.org/10.5944/ried.24.1.28080

García-Cepero, M. (2010). The study of academic productivity of university professors through confirmatory factor analysis: the case of psychology in the United States of America. Universitas Psychologica, 9(1), 13-26. https://doi.org/10.11144/Javeriana.upsy9-1.epap

González, M., Lafuente, E. and Mato, J. (1989). Productivity and efficiency of university departments: analysis of the University of Oviedo. Asturian Journal of Economics, 14, 149-172.

Gordillo, J., Sánchez, Y., Terrones, A. and Cruz, M. (2020). Academic productivity in higher education institutions in Mexico: from theory to practice. Purposes and Representations, 8(3), e441. https://doi.org/10.20511/pyr2020.v8n3.441

Hernández, Y., Hernández, G. and Mendieta, A. (2013). Personnel rotation model and organizational practices. History and social communication, 18 (December Special), 837-863.

International Labor Organization. (1986). Vocational training: Glossary of selected terms. Retrieved from https://bit.ly/2U1iCT4

International Labor Organization. (May 14, 2020). COVID-19: G7 nations must implement gender equality so that the future of women at work is better. Press release. Geneva: International Labor Organization. Retrieved from https://bit.ly/3NRCcKM

International Labor Organization (2020). Teleworking during the COVID-19 pandemic and beyond – A practical guide. Retrieved from https://bit.ly/3yvSzry

Head of State of Spain (2018). Organic Law 3/2018, of December 5, on the Protection of Personal Data and guarantee of digital rights. BOE-A-2018-16673. Recovered from https://bit.ly/3uDbLl5

Latorre, E., Castro, K. and Potes, I. (2018). ICT, TAC and TEP: educational innovation in the conceptual era. Bogotá: Sergio Arboleda University.

Maletta, H. (2016). Do science. Theory and practice of scientific production. You. Pacific, Ed.

Martínez, C., Martínez, R. and Vázquez, D. (2022). Competencies in university teaching staff derived from the impact of COVID-19. Ibero-American Journal of Education, 88(1), 101-109. https://doi.org/10.35362/rie8814823

Ministry of Science, Technology and Innovation. (February 25, 2021). National call for the recognition and measurement of research, technological development or innovation groups and for the recognition of researchers of the National System of Science, Technology and Innovation-SNCTI 2021. Retrieved from https://bit.ly/3IoKQiu

Ministry of National Education. (June 2002). Decree 1279 of 2002. By which the salary and benefits regime for teachers at State Universities is established. Retrieved from https://bit.ly/3yk83ha

Ministry of National Education. (November 19, 2020). Resolution 21795 of November 2020. Bogotá, Colombia. Retrieved from https://bit.ly/3P8qBYw

Montero, V., Aguilar, M. and García, O. (November 2013). XII National Congress of Educational Research - In search of academic productivity: the construction of collective forms of work in a public university in Mexico and the United States. Retrieved from https://bit.ly/3Pfo7ba

Monterrey Technological Observatory. (February 17, 2022). Does the four-day work week work? Retrieved from https://bit.ly/3awYjs2

Ramiro, J. (11/22/2021). Everyone should have the tightness to disconnect from work. Jacobin. Recovered from https://bit.ly/3uDbXRl