Ergonomic Analysis of the Impacts of Covid-19 on Production Engineering Professors at UFAM

Bruno César Macedo Auzier, Jeniffer Andrielle Pereira da Silva, Marcelo Albuquerque de Oliveira, Gabriela de Mattos Veroneze, Dercio Luiz Reis, and Joaquim Maciel da Costa Craveiro

ABSTRACT

In the contemporaries of the Coronavirus Pandemic, the working from home was adopted as a health prevention measure. This article aims to analyze the ergonomic, emotional, and psychological aspects arising from this new way of working with professors of the Production Engineering Department of the Federal University of Amazonas - UFAM. The study is descriptive and was elaborated by literature review, and data survey through online interviews. The participants answered a questionnaire in which it was verified the points that directly interfere in the quality of life and performance of the professors in their professional activities. According to the results obtained, it was found that the reality faced by the workers is divergent from the standards established by ergonomic norms. It was also observed that the sharing of personal and professional life caused worries, stress, and anxiety, impacting on the educators' emotional health. Finally, we recommended possible solutions to mitigate the negative effects of this new way of working.

Keywords: Emotional Health, Ergonomics, Production Engineering, Working from Home.

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Bruno César Macedo Auzier*
Graduation student in Production Engineering,
Federal University of Amazonas.

(e-mail: brunnoauzier@gmail.com)

Jeniffer Andrielle Pereira da Silva
Graduation student in Production Engineering,
Federal University of Amazonas.

(e-mail: jenifferandrielle.ps@gmail.com)

Marcelo de Albuquerque de Oliveira
Professor, PhD, Master's Program in
Production Engineering, Federal University of
Amazonas.

(e-mail: marcelooliveira@ufam.edu.br)

Gabriela de Mattos Veroneze
Professor, PhD, Master's Program in
Production Engineering, Federal University of
Amazonas.

(e-mail: gveroneze@ufam.edu.br)

Dercio Luiz Reis
Professor, PhD, Master's Program in
Production Engineering, Federal University of
Amazonas.

(e-mail: dercioreis@ufam.edu.br)

Joaquim Maciel da Costa Craveiro
Professor, PhD, Master's Program in
Production Engineering, Federal University of
Amazonas.

(e-mail: jmaciel@ufam.edu.br)

**Corresponding Author*

I. INTRODUCTION

Because of the new reality, the teachers need to cope with the pressure of adapting to the virtual mean, implementing new strategies of education and learning, as well as occupy themselves with personal questions. The current study becomes relevant due to examining the transformations caused by COVID-19 within the teachers' work relation.

The teachers had to reorganize their personal and professional lives because of the pandemic. Nevertheless, how has it been done and how do they see their responsibility at the given moment?

It has observed the work conditions and the emotions amidst the pandemic, searching for identifying the changes caused by home-office. It is awaited that the obtained results can contribute to amplify the debate on the theme.

The research will analyse intrinsic aspects to the work conditions of teachers from the Production Engineering department of UFAM (Federal University of Amazonas). It is questioned about the features that negatively influence this process, and it has made an ergonomic, emotional, and psychic analysis amidst the pandemic.

Therefore, the research central problem can be expressed by the subsequent question: In any institution, it must be taken as a basis the wellbeing of their collaborators. It is necessary to make the following question: Which aspects must be taken into account to improve the work conditions of education professionals in the home-office?

The research object will be constituted by the elaboration of a form and answer analysis of the interviewed people with the aim to identify the challenges faced amidst the COVID-19.

II. LITERATURE REVIEW

A. Home-office Historic Context

To understand what Home-office means it is necessary to understand the context in which this term has arisen. This category has come out as an innovation in 1970 along with the oil crisis. It was a strategy that had as aim decreased the traffic issues because of the fuel, what has been possible only due to technology's enhancement? According to Oliveira (1996), the cybernetic revolution gave rise to a new work category, the 'working distance', which can be done anywhere. Only in 1990 that this category has moved forward because of the massive growth of technologies (Bernardino *et al.*, 2009; Costa, 2004).

The first term that arose referring to a new category was "telecommuting" (telework) and has shown in a publication in the United States on the book "The telecommunications-transportation tradeoff: options for tomorrow", and it mentioned the elimination of the route homework through the Information and Communication Technologies – ICTs (Costa, 2004; Niles, 1996). In 1999, it was spotted by Castells (2008), in his work "The network society" this increasing tendency of people to work and manage services at their homes.

According to Trope (1999), the concept of home-office is the inversion of the traditional, the work comes to people. According to the author, the employee working in his domicile can be classified as *home-office*. Rafalski and De Andrade (2015) define the characteristics of Home-office such as the work that can be done in any environment independently of size and propriety definition, it's a space that is destined to professional activities inside your house. It can or not necessarily involve other.

There are other nomenclatures such as Local Office, Home Based, Mobile Office, Working Distance, Work at Home, Virtual Office, among others, but all of them refer to the non-personal work.

The Home Office came up more than 50 years ago. It brought changes in the way of doing the work, in which people do their activities at their houses, keeping the bond with the organization. In Brazil, it started with private companies and was regulated in the year of 2017 with the labor reform. It was defined according to the article 75-B of CLT as the provision of services done predominantly out of the company dependencies with the use of tools of information and communication technologies.

A current important fact is that the work at home has shown to be the most adequate solution at the pandemic moment, significantly decreasing the contamination risk and propagation of COVID-19, with this category the employers guarantee the concern about the health of their employees.

B. Teleworking and Its Benefits

A notable advantage of home-office is in the possibility of equilibrating more efficiently the house obligations and work chores. Understanding the personal and professional life don't need to be the opposite, it's necessary to understand that remote work allows familiar conviviality and execution of professional commitments harmoniously and when well-balanced it brings more productivity to the collaborators.

According to research carried out with 417 teleworkers, [9] expose the main positive effects of this model are: pressure

reduction, work divergence reduction and bigger autonomy of the collaborators.

On the other hand, it has also been observed to have negative effects such as worker support reduction, increase of professional ambiguity and feedback decreasing. It observed negative results on the health of the collaborators coming from their emotions, worries, stress, irritability, and loneliness (Golden *et al.*, 2008).

C. Home-office Labor Risks

With the aim of the collaborator to reach positive results, in life quality and productivity, it is necessary to foresee and identify the main risk ergonomic factors and correct them.

The basic principle of ergonomic is that work ought to be adapted to men, with the aim to preserve its physical, emotional, and psychic health. Therefore, it is essential that the established space to be home-office follow the criteria established on NR-17 (2018). In other words, "adapt the work conditions to the workers' psychophysiological characteristics, in order to provide maximum comfort, security and efficient performance".

On the collaborators' routine that does his activities without the work environment adequate, it can cause serious risks to his own healthiness. From the effect of the poorly adapted work, it has proposed the Ergonomic. Therefore, the men since the beginnings try to adapt the objects or tools invented in order to be the most comfortable as possible to its handling.

In this sense, there is the urgency to adequate the work environment for human beings, and make other companies take into account the importance of people's healthiness in the workplace (Oliveira, 1996).

D. Home-office Labor Risks

Nowadays, the work routine, the social meetings, and the conviviality with our families changed, many of these social interactions started being done at home, and therefore the need of adaptation has become evident in all areas. The use of a computer has become necessary to almost all the activities that before used to happen in the external environment.

Nevertheless, this sudden adaptation does not always take into account the ergonomics aspects. According to Iida and Guimarães (2016), this concern came up on the Second World War, when the appearance of new technologies created complex tools that the operator person did not have conditions to do its own work. Mistakes and accidents became frequent taking the attention toward the creation of means that could adapt the tools to the capacity and characteristics of who used it.

According to Laville (1977), the ergonomic concept occurred due to the advent of practical needs and defined as the man's knowledge over its performance in activities. It has as aim the machinery, tools and even environment involving the entire system enhancement. It is a Science that embraces the physiology, work psychology and anthropometry, where are created standard applications. Avancini and Ferreira (2003) reinforce that ergonomic has as its aim makes activities and work environments safe, comfortable, and productive to men.

The International Ergonomics Association – IEA defines this discipline as scientific, always looking for the best way as possible of making the person keep in touch with the

elements. A study helps in planning and execution of environments making them compatible to the needs and human limitations (ABERGO, 2020).

To Panero and Di Marco (2016) the integration area between who is going to use the space and the space that is going to be used has to guarantee the best experience as possible. Therefore, the dimensions become variable according to the characteristics of the user. Turning this science to the teleworkers at home, it searches for improving interactions according to the life reality of everyone with the work to a better efficiency and efficacy of its functions.

The International Work Organization defines ergonomics as constant adjustment between man and his work environment according to the Brazilian Society of Ergonomics (ABERGO), "Ergonomics is the study of work adaptation to the physical and psychological characteristics of the individual".

To Moraes and Mont'alvão (2010) ergonomics is a body of knowledge about the human abilities, human limitations and other human characteristics that are relevant to design. Ergonomic project is the application of ergonomic information to the design of tools, machines, systems, tasks, works and environments to the safe, comfortable, and effective human use. The significant word within these definitions is design because it separates disciplines purely academic such as anthropology, physiology and psychology.

E. Ergonomic and Postural Aspects in Healthiness Management

The ergonomic questions involve design and the relation with the user always aiming for the well-being of who uses the projected environment, avoiding physical problems. Essential elements of the environment are furniture and the used equipment, because when projected wrongly, they can cause bad consequences to the worker's health such as muscle fatigue and column lesions.

Not only the environment, but the corporal position also creates health problems. Some precautions must be taken, such as leave the shoulders, elbows, fists, and knees in comfortable and neutral positions; use preferably sits with backrest and support to the back region; keep the feet supported on the floor; support the forearm on the accessory to the chair or in case you do not have, support on the table itself.

F. Home-office and the Ergonomics on the Work Conjunction

Faced with the distancing exigency and social isolation due to the COVID-19 pandemic, world organizations figured out work from home was a great opportunity.

This new work concept presented financially to the corporations aiming to promote a greater economy, there are not doubted that this work method is promising and will be enhanced as time passes by, once it is positive to the institutions.

As far as home-office is identified as a way to reduce costs on organizations (Pratt, 1984). It is vital to convert the saved resources to support the worker to get used to the work circumstances at home and gives conditions to the practice of their tasks. It is evident that the adaptation of a new work area, when poorly done, causes damages to the collaborator's health, such as the feeling of distancing from the company,

the same way as difficulty organizing tasks, cooperating to instability of professionals in organizations (Rasmussen and Corbett, 2008).

G. The Influence of Psychic Factors on the Worker's Healthiness

The circumstances in which the work is done carry out direct influence on the individuals' lives. Once many cases the person goes through the biggest part of the day working. It is essential to obtain proper conditions, so we do not get sick. Therefore, it is necessary to have good health to perform our services properly.

Because of the coronavirus pandemic, there were alterations on work relations. To the workers, besides the transformation on the professional field, there were also changed on the personal scenario. It was necessary to adjust the household environment so that it could be an able place to carry out the tasks, which many times has shown to be difficult. The business restructure requires work more with less people (Barreto, 2003). Consequently, this unsure on workplaces, as well as the uncertainty caused by the pandemic has affected the worker's healthiness.

According to the WHO (2021), "Healthiness is a full state of physical, mental and social well-being and not merely the absence of sickness". Besides that, "Mental health is the equilibrium of the personality considered on its biopsychosocial entirety. The capacity to think, to adapt to reality, capacity to perform different social functions, the capacity to cope with the biggest part of daily problems. The mental perturbations are diseases characterized by emotional, cognitive and behavioral order perturbations."

Data from WHO (2021) indicate that 2.02 million of people die each year due to diseases related to working; 321.000 people die each year as the consequence of work accidents; 160 million of people suffer from non-mortal diseases related to working and 317 million of occupational accidents non-mortal occur each year. This means that 15 seconds, a worker dies of accidents or diseases related to working, and 115 workers suffer occupational accidents. In Brazil, 390 thousand of work accidents occur, from these, 12 thousand leave people unable to work, with an average of 7 to eight deaths per day.

III. METHODOLOGY

The research, over the optic of its proposal, it's characterized as descriptive once it's proposed to portray the circumstances of which teachers of Production Engineering of UFAM work. According to technical methods, it has been chosen to use the study case, due to proportionate answers to the issues of practicality. According to the problem used in quantitative research, that in accordance with Provdanov and Freitas (2013), "everything can be quantifiable, which means to translate into numbers and opinions and information to classify and analyse them".

Due to the coronavirus pandemic and the decree n° 626 of 13 of March of 2020 (2020), which suspended all the academic and administrative present activities for undetermined time in the university, it was chosen to create an online questionnaire by the platform (Google forms).

The platform choice allowed more practicality and higher outreach to the research. It created a questionnaire over the supervision of the leading teacher with the aim to get clearness on data obtained.

It was forwarded an invite by e-mail and by the app WhatsApp convening the participants of the research to answer the form. The time to obtain the minimum of answers determined by the researchers was two weeks between the period of 16/09/2020 to 30/09/2020, proceeding to the analysis of the obtained answers.

Within the questionnaire conception, it was prioritized the elaboration of three questions on basic areas: material, physical and emotional. Firstly, questions were asked to the participants about the quality and the types of materials that they used on their home-office. Later questions about the physical infrastructure of the workplace were asked. Finally, were asked questions about the emotional, division between personal and professional life and the interferences on the performance and productivity in home-office.

IV. RESULTS AND DISCUSSIONS

In the current conjecture caused by the coronavirus pandemic, the educational institutions felt the social and economic impacts. Due to class suspension and the collaborators at home, there was the need of creating new ways and more efficient ways to soften the impacts caused by COVID-19.

It was carried out research with teachers of the department of Production Engineering of UFAM who work at the city of Manaus, that have eleven teachers and seven answered the survey, obtaining a tax rate of 63.63%.

It was analysed the environmental, ergonomic, and emotional aspects searching to know the factors that influence over the teacher performance in home-office.

When asked about the mentioned workplace, 85.7% of the participants showed to have good illumination in their work environment, although, 14.3% considered that their luminosity conditions aren't in the requirements established by the regulatory standard-17 (NR-17, 2018).

The noise is an important spot that must be analysed, because when it exceeds it affects people's health in the end. As soon as it trespasses upon the limit established, it creates lesions on the auditory apparatus that can cause psychic stress from the sonorous perturbations of the environment.

Suddenly, the teachers had to adapt their work routine to home. This new reality has brought a great challenge to fit the home environment with the realization of their professional activities. Interruption during the work caused by the sharing or proximate of the environment with people doing different activities is a prompter agent of greater wear by the interviewed people, according to the Fig. 1.

The Peninsula Institute research, carried out on the days of April 13 and May 14 of 2020 with 7.734 mil educators of the whole Brazil, showed that only 17% feel prepared for remote education.

As an answer, the teachers of the department of Production Engineering showed that 28.6% of the interviewed considered their knowledge about the applications used to give remote classes as "excellent", otherwise 71.2% have a little domain over the instruments.

Fig. 1. Uncomfortable noises in home-office.

Right now, many are feeling overwhelmed, especially those who have had to reinvent the way they work. These professionals are having to change their way of teaching developing new methodologies for this scenario. 85.7% of the professors stated that there was an increase in workload at the home-office compared to personally work.

Moreover, it is not just the new ways of teaching classes that shake the category. The new conceived horizon also affects the psychological part of individuals. Data from Institute Peninsula indicated that 50% of respondents in Brazil are concerned about mental health.

Most of them feel worried, anxious, overwhelmed, stressed, and sad. These are the constant feelings of home-office workers, as shown in Fig. 2.

Fig. 2. Main emotions in Home-office.

The research indicated that due to the routine change and the difficulties of remote work, new conditions of healthiness worsened or came up. The interviewed workers complained about the myopia that it actually got worse, emergence of chronic pains, weight gain, anxiety, depression and unregulated rates in general.

Therefore, it is crucial to look after the physical and mental health, understands their limits and looks for help when necessary so all the areas are in equilibrium even in the face of adversities.

V. CONCLUSIONS

The COVID-19 pandemic has brought sudden change on the way to give classes, in a context where social distancing is an obligation. The fear and uncertainty about the future established a new work routine at home to the workers,

causing a great challenge in their lives.

To those who did not have experienced working at home, adapting to this routine is challenging. All this process has generated an increase in the work quantity of educators. A great difficulty was the knowledge level about the virtual tools of teaching and learning.

In home-office, the work time normally trespasses the present. It might seem that hours are passing quicker and that your work is not being useful, with this, the teachers keep working until later. Although, when well applied the ergonomic interventions on the work environment, the educators can obtain more efficiency and will focus on their activities.

It is notable that many teachers cannot define a fixed schedule and place to work, in the current situation even less.

Thus, it must be created a habit of schedules to the beginning and end of chores to be done on their daily routine, reaching equilibrium in all the areas of them.

It is also important that the teacher set aside some time to practice physical exercises, essential tools in the fight against depression and anxiety, because they release endorphins, one of the hormones responsible for the pleasure sensation.

Another indispensable spot to the health maintenance of workers is the sonorous factors that can cause perturbation and other auditory problems and must be avoided analyzing the levels of noise and establishing maximum limits to exposition.

These problems are not exclusive to teachers from the Production Engineering department. Other professionals are also going through the same troubles, this way the application of good practices and the emotional support are necessary to cope with the anguish and anxiety of the current scenario.

Therefore, it has concluded that the current state has accomplished the objective of its purpose. It is proposed that the research must be applied to other academic units of the university so that it can reach a bigger understanding of the reality of the teachers from the institution as a whole and the factors that impact on their performance and health, as well as a suggestion of changes that can result in a possible solution.

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Bruno César Macedo Auzier is a student of Production Engineering at the Federal University of Amazonas, and researcher under SUPER project.

Jeniffer Andrielle Pereira da Silva is a student of Production Engineering at the Federal University of Amazonas, and researcher under SUPER project.

Marcelo Oliveira is an Adjunct Professor of Department of Production Engineering and member of Master Program in Production Engineering, Federal University of Amazonas. He has published several Research Papers related to Engineering area.

Gabriela Veroneze is an Adjunct Professor, Department of Production Engineering and member of Master Program in Production Engineering, Federal University of Amazonas. She has published several Research Papers related to Engineering area.

Dércio Reis is an Adjunct Professor, Department of Production Engineering and member of Master Program in Production Engineering, Federal University of Amazonas. He has published several Research Papers related to Engineering area.

Joaquim Craveiro is an Adjunct Professor, Department of Production Engineering and member of Master Program in Production Engineering, Federal University of Amazonas. He has published several Research Papers related to Engineering area.