

The implications of the Covid-19 pandemic: Repercussions on the academic-scientific activities of postgraduate faculty in Industrial Engineering in the southeast region of Brazil

As implicações da pandemia Covid-19: Repercussões sobre as atividades acadêmico-científicas de docentes de pós-graduação stricto sensu em Engenharia de Produção da região sudeste do Brasil

Las implicaciones de la pandemia Covid-19: Repercusiones sobre las actividades académico-científicas de profesores de posgrado en Ingeniería de Producción en la región sudeste de Brasil

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Abstract

The Covid-19 pandemic has brought a series of challenges and transformations to various sectors of society, including higher education. This article presents part of the results of a study that investigated the implications of this phenomenon on the work of a group of faculty members assigned to stricto sensu graduate programs in Industrial Engineering in the Southeast region. These programs play a direct role in training highly specialized professionals, either for the field of scientific research and/or the business environment. On a national scale, the Southeast region significantly accounts for 57% of these programs. By analyzing the changes, adaptations, challenges, learning experiences, and gains in the context of the pandemic, the study sheds light on the various facets of the manifestation of this event, covering topics and situations typical of the work of faculty members operating at this educational level. The article highlights the repercussions on the teaching, research, and outreach activities of the faculty by identifying the need for adaptations and revisions, as well as implications related to the development of remote work. The study was conducted with the support of a literature review and a qualitative field survey. It involved 55 faculty members from 11 programs in the mentioned region. Data collection took place online under the supervision of one of the article's authors and was carried out in May 2023. The study is linked to research investigating the impact of the Covid-19 pandemic on the work of faculty members, specifically in the field of Industrial Engineering in stricto sensu postgraduate programs.

Keywords: Postgraduate stricto sensu; Production engineering; Teaching work; Covid-19 impacts.

Resumo

A pandemia de Covid-19 trouxe uma série de desafios e transformações para diversos setores da sociedade, dentre eles, a educação superior. Este artigo apresenta parte dos resultados de um estudo que investigou as implicações deste fenômeno sobre o trabalho de um grupo de docentes alocados em programas de pós-graduação stricto sensu, em Engenharia de Produção, da região Sudeste. Estes programas atuam diretamente na formação de profissionais altamente especializados, seja para atuar no campo da pesquisa científica ou/e no meio empresarial. No contexto nacional, a região sudeste responde significativamente pela oferta de 57% desses programas. Ao analisar as mudanças, adaptações, desafios, aprendizados e ganhos no contexto da pandemia o estudo lança luz sobre as diversas facetas da manifestação desse evento, cobrindo temas e situações típicos do trabalho dos docentes que atuam neste nível educacional. O artigo mostra as repercussões sobre as atividades de ensino, pesquisa e extensão dos docentes pelo apontamento de necessidades de adaptações e revisões, bem como implicações relacionadas ao desenvolvimento do trabalho em meio remoto. O estudo foi desenvolvido pelo apoio de uma revisão bibliográfica e de uma pesquisa de campo de abordagem qualitativa. Dele participaram 55 docentes de 11 programas da referida região. A coleta de dados ocorreu em modo online com a supervisão de um dos autores do artigo e foi desenvolvida em maio/2023. O

estudo se liga às pesquisas que investigam a repercussão da pandemia Covid-19 sobre o trabalho de docentes, especificamente, da Engenharia de Produção da Pós-Graduação stricto sensu.

Palavras-chave: Pós-graduação stricto sensu; Engenharia de produção; Trabalho docente; Impactos Covid-19.

Resumen

A pandemia de Covid-19 ha traído una serie de desafíos y transformaciones para diversos sectores de la sociedad, entre ellos, la educación superior. Este artículo presenta parte de los resultados de un estudio que investigó las implicaciones de este fenómeno en el trabajo de un grupo de docentes asignados a programas de posgrado stricto sensu en Ingeniería de Producción en la región Sudeste. Estos programas están directamente involucrados en la formación de profesionales altamente especializados, ya sea para trabajar en el campo de la investigación científica y/o en el entorno empresarial. En el contexto nacional, la región sudeste representa significativamente el 57% de la oferta de estos programas. Al analizar los cambios, adaptaciones, desafíos, aprendizajes y ganancias en el contexto de la pandemia, el estudio arroja luz sobre las diversas facetas de la manifestación de este evento, abordando temas y situaciones típicas del trabajo de los docentes que actúan en este nivel educativo. El artículo muestra las repercusiones sobre las actividades de enseñanza, investigación y extensión de los docentes mediante la identificación de necesidades de adaptación y revisión, así como las implicaciones relacionadas con el desarrollo del trabajo de forma remota. El estudio se llevó a cabo mediante el apoyo de una revisión bibliográfica y una investigación de campo con enfoque cualitativo. Participaron 55 docentes de 11 programas de la mencionada región. La recopilación de datos se realizó en línea con la supervisión de uno de los autores del artículo y se llevó a cabo en mayo de 2023. El estudio se conecta con investigaciones que exploran el impacto de la pandemia de Covid-19 en el trabajo de docentes, específicamente en el campo de la Ingeniería de Producción de la posgrado stricto sensu.

Palabras clave: Posgrado stricto sensu; Ingeniería de producción; Trabajo docente; Impactos Covid-19.

1. Introduction

The tragic events that permeate the trajectory of humanity inevitably leave a trail of reflections, lessons, and transformations. This pattern also manifested itself in the pandemic that erupted in 2019 and became known as Covid-19, triggering a series of emergency and immediate measures worldwide from 2020 onwards. Recognized as the largest pandemic of the 21st century to date, its origin lies in the global spread of the SARS-CoV-2 coronavirus, affecting humanity comprehensively, encompassing nations on all continents and leaving its mark on various sectors and strata of society. This crisis propelled emergency changes, including in the field of education.

According to Diamond (2013), diseases have the power to influence human behavior on a global scale, constituting one of the three historical catalysts along with wars and revolutions that shape the course of the evolution of societies.

In the educational sphere, one of the immediate responses adopted globally was the implementation of Emergency Remote Education (ERE), a practice that in Brazil was implemented from March 2020. However, one of the immediate implications of this measure was the increase in emotional exhaustion, both for educators and students, justified by the abrupt impacts on working conditions and the development of the teaching-learning process.

According to UNESCO data (2021), in April 2020, approximately 1.7 billion students, ranging from preschool to higher education, were affected by school closures. In the Brazilian context, the organization reports that about 53 million students were affected, with 8.6 million coming from higher education. Estimates found that around 90.2% of students in 191 countries were impacted by the social isolation measures resulting from the Covid-19 pandemic.

In this scenario, the measure implemented to prevent the complete halt of educational activities was Emergency Remote Education (ERE). However, this transition occurred without proper training to facilitate the integration of teachers and students with the new online interaction tools, which immediately required adaptations to traditional forms of interpersonal relationships (Ghisleni, 2020).

Although it was a necessary measure, it highlighted the fragility of the Brazilian educational system, revealing the situation of teachers and students regarding access to digital means and modes of interaction. A significantly large number of students, especially those from public schools, had never had access to the internet at home, let alone computers or mobile

devices.

According to data from the Continuous National Household Sample Survey - PNADC Brazil (2021), this number surpasses the 40 million mark. For this extensive student population, the Covid-19 pandemic generated particularly impactful consequences due to the physical and emotional distance from teachers and schoolmates.

These observations sparked interest in investigations regarding the implications of the Covid-19 pandemic in the realm of teaching work, encompassing variables that outline adverse effects, as well as the inherent peculiarities of each context and educational level. Such studies sought to analyze the repercussion of the phenomenon in different educational settings, at various levels of education, considering working conditions, infrastructure, and the quality of life of teachers, among other factors.

The study in its entirety investigated the repercussions on the work activities of *stricto sensu* postgraduate professors in Production Engineering in the Southeast region, covering topics related to changes, adaptations, challenges, learning experiences, losses, gains, and the use of crisis coping skills. For this purpose, the following research question was posed: What are the implications of the pandemic on the activities of professors assigned to *stricto sensu* postgraduate courses in Production Engineering in the Southeast region during the period of social isolation?

This article presents part of the study's results, showcasing the main repercussions of the Covid-19 pandemic on teaching, research, thesis/dissertation guidance, as well as those related to participation in scientific-academic events. It is structured with this introduction, a literature review on teaching during the pandemic and its adverse effects on teaching work. It also includes information on the methodology and methodological procedures adopted for its development and results, and final considerations.

Adverse Effects of the Pandemic on Professor's Work

An implementation of remote teaching during the Covid-19 pandemic was established as mandatory through ordinance number 343 of 2020, aimed at higher education institutions within the federal education system. From this point on, and based on Law 14,040 of 2020, subsequent decrees and ordinances were issued to ensure the feasibility of Emergency Remote Education (ERE) as an exceptional measure. These actions allowed the use of digital educational resources for the complete fulfillment of the pedagogical activities' workload. This scenario prevailed until the end of measures mandating the return to classes in late 2021, solidifying thereafter in 2022 (Brazil, 2020).

Studies conducted in the context of the COVID-19 pandemic by Jaques (2022), and Marques (2022) have revealed the repercussions of the increase and prolongation of both quantitative and qualitative demands on teachers' work. Others extensively address the repercussions on the health of both teachers and students (Bianchetti & Martins, 2018; Lima et al., 2021; Almhdawi et al., 2021; Viana & Souza, 2021; Freitas et al., 2021; Mccutcheon & Morrison, 2018; Sethi et al., 2017), exposing the interest in highlighting issues related to the precariousness of teaching work (Jaques, 2021; Rodrigues, 2020). These studies point to the emergence of persistent exhaustion and emotional burnout among these professionals, aspects that notably characterize the fragility of teaching work conditions. Within this set of research, the study by Baeriswyl et al. (2021) emphasizes the importance of investigating the elements contributing to teachers' stress. In turn, Dolighan and Owen (2021) identified specific variables, such as teaching experience, professional development, and educational support, as relevant factors correlated with teachers' perceptions of self-efficacy during the transition to online teaching amid a pandemic.

Teachers also constituted a group directly affected by the adopted emergency measures. The study conducted by Valente et al. (2020) identified a significant increase in pressure on these professionals as they were prompted to quickly assimilate new technologies for remote teaching. Additionally, they faced unsatisfactory conditions in their home infrastructure

adapted to conduct their professional activities, along with the new dynamics of family life in a confined environment. Added to this is the sorrow of those who experienced the loss of loved ones and friends, as well as emotional exhaustion resulting from feelings of uncertainty and insecurity about the future of their careers and jobs.

Santos (2020), addressing teaching and pedagogy in the face of the impact of Covid-19, emphasizes that every pedagogical act has a humanizing or dehumanizing dimension, an aspect of utmost importance and relevance that requires profound reflection on the human experience. In this vein, a study published in *Social Education* (2020) in the United States revealed that some teachers expressed a sense of longing for the experience of being together in a special space, such as school, where they learned together and supported each other. One participant in the research expressed this feeling by stating: "I believe our true sense of community comes from the academic experiences we share." (Staff, 2020, p. 150). The study suggests that this dimension was minimized in the context of Emergency Remote Education (ERE).

A persistent exhaustion translates into the continuous repetition of fatigue and physical and mental tiredness to which teachers are subjected while carrying out their teaching duties, especially during the period of social isolation. This is directly linked to emotional burnout, which is widely influenced by the extension of working hours and the lack of social contact. As a result, this reality gives rise to a scenario of uncertainties regarding the future of the profession, contributing to an increase in job turnover, temporary leaves, substitutions, dismissals, and a lack of prospects, among other implications. All these actions inevitably impact the sought-after outcomes in the educational sphere, potentially compromising both individual and organizational goals (Baeriswyl et al., 2021).

Research of this nature aims to broaden the understanding of the mechanisms underlying emotional exhaustion, seeking to illustrate how the effects resulting from the extension of remote working hours, lack of social interaction, uncertainties about the future, and other factors that emerged or were intensified in the context of Covid-19 are contributing to the increase of this phenomenon. Additionally, they retrieve results from previous research showing how social phenomena marked by high emotional crisis are more strongly correlated with organizational consequences, such as turnover rate (Alarcon, 2011), performance (Taris, 2006), psychological responses, and physiological stress (Lee & Ashforth, 1990). These considerations have substantial implications for promoting health in the workplace, according to Baeriswyl et al. (2021).

The research conducted by Silva et al. (2020) revealed that in the pandemic scenario, pre-existing concerns such as productivity and excessive workload of teachers not only persisted but also intensified. The authors observed that teachers worked beyond the usual, maintaining high levels of academic production, transforming their homes into work environments, continuing remote activities even in the absence of proper preparation and favorable conditions to operationalize them, and dealt with health problems arising from this context.

2. Methodology

The study was conducted through a literature review and the application of a qualitative research approach, with this approach being a means employed "[...] to explore, describe, and understand what individuals or groups attribute to a social or human phenomenon" (Creswell, 2010, p.26). According to Marconi and Lakatos (2003), qualitative studies aim to analyze and interpret a phenomenon in order to elucidate the facts to the point of being able to describe them even when complex.

As for its purpose, it is descriptive research, as conceptualized by Rampazzo (2005, p. 53), characterizing it as a type of investigation that is dedicated to observing, recording, analyzing, establishing relationships, and studying facts present in the physical environment, without the researcher's opinion being an intrinsic element.

Based on information collected from the CAPES Sucupira platform in October 2022, it was found that the Engineering III area in Brazil encompasses a total of 126 programs, distributed in the following subareas: Space Engineering,

Mechanical Engineering, Naval and Oceanic Engineering, as well as Production Engineering. Within this set, the Mechanical Engineering subarea stands out, encompassing the highest number of programs, totaling 64, followed by Production Engineering, with a total of 53 programs.

When analyzing the distribution of these programs, it was observed that together they offer a total of 186 master's and/or doctoral courses, in academic and professional modalities. Out of this total, 77 are in the Production Engineering subarea. Among this range of courses, it is noted that 48% are academic master's degrees, 30% are academic doctoral degrees, 21% are professional master's degrees, while only 1% corresponds to professional doctoral degrees.

The Southeast region, in addition to hosting the highest number of *stricto sensu* programs in the Engineering III area, is also responsible for 56.6% of the Production Engineering programs offered throughout the country, followed by the Southern region, which contributes with 22.6%. The sum of the numbers from these two regions results in approximately 60% of the mentioned programs, while the Northern region represents only 1.9%. Notably, no *stricto sensu* graduate program in Production Engineering was found in the state of Espírito Santo. This fact justifies the concentration of these programs in the states of São Paulo, Minas Gerais, and Rio de Janeiro.

According to Furbino et al. (2016), the concentration of programs in the Southeast region may be related to the presence of large companies and industries that employ highly qualified professionals to meet their demands. Additionally, the presence of major universities and research centers in the region also justifies the expansion of the number of *stricto sensu* graduate programs in Production Engineering.

As stated by Lima and Kato (2018), the concentration of most universities and research centers in the country may explain why the region has the highest number of *stricto sensu* graduate programs in the area. The training of highly qualified human resources is crucial for the scientific and technological development of a country. In addition to *stricto sensu* graduate programs, the Southeast region of Brazil also has many undergraduate courses in Production Engineering, contributing to the training of highly skilled professionals in this field (INEP, 2021).

The region is also known for being a center of innovation and entrepreneurship. For instance, the state of São Paulo concentrates the largest number of startups in the country, in addition to hosting a significant number of incubators and business accelerators (SEBRAE, 2021).

This region is also responsible for a substantial quantity of patents registered in the country. A study conducted by the National Institute of Industrial Property – INPI (2021) showed that in 2020, the region accounted for 60% of the patents registered in Brazil.

Data collection for the study was carried out through a structured questionnaire administered online using Microsoft Forms, conducted, and supervised by one of the study's authors. According to Gil (2009), this instrument is a research technique consisting of a set of questions formulated to acquire information and generate essential data to achieve the objectives established in a research project.

Regarding the research participants, initially, they were identified through the programs' websites, revealing the existence of 546 faculty members, all allocated in the 30 programs. However, the questionnaire was effectively sent to 440 faculty members, distributed among 22 programs. This discrepancy in the number of faculty members/programs is justified due to: (a) certain programs not providing email addresses of faculty members on their pages, displaying only their names, and (b) some programs (or courses) updating their pages during the research execution period, resulting in the exclusion of certain faculty members from their lists.

Through the academic email addresses of the faculty members (made available on the programs'/courses' pages), each of the 440 faculty members received an invitation to participate in the survey. The invitation contained detailed information

about the research, its objectives, the researcher/supervisor, the originating higher education institution (IES), and instructions for participation and questionnaire completion. After the end of the established data collection period (May 2023), 55 completed questionnaires were returned to the researcher, constituting the number of participants. This number represents a participation rate of 12.5% concerning the total number of invited faculty members.

3. Results and Discussion

As teaching activities investigated covered aspects related to teaching, research, guidance of dissertations/theses, and the participation of faculty members in scientific/academic events. For each activity, a set of response alternatives was provided, projecting the potential impacts that could occur. These impacts encompass the likelihood of the need for adaptations, changes, and/or the occurrence of losses, postponements, and cancellations, the emergence of new needs, suspensions, and other similar situations.

Upon analyzing the obtained responses, it was found that to express the "implications of the pandemic on academic-scientific activities," 257 responses were generated by the 55 faculty members, within a set of 10 possible implications that could have occurred. All 10 alternatives received comments, except for "loss of the condition of productivity scholarship," indicating that this did not occur. In contrast, the "distancing from peers (work colleagues, coordination, support team)" was the occurrence with the highest number of responses. It was also found that faculty members considered this occurrence negative because it implied the absence of the relationships inherent in the practice of the profession and routinely developed in the work environment.

Despite this result, Carlotto (2002) is recalled, commenting that the interaction between education professionals and others involved in the educational process, such as peers, school administration, and government authorities, requires significant attention from faculty members. It is essential to establish strong connections to enable the effective implementation of the teaching-learning process.

Following the obtained responses, the "suspension/postponement of activities related to organizing/participating in events" received the second-highest number of responses. This observation aligns with the guidelines issued by the Ministry of Health (2020) during the pandemic, suggesting the cancellation or postponement of events involving many participants due to the spread of the new coronavirus (Covid-19) epidemic.

According to the instructions of this Ministry, local authorities were encouraged to promote the non-realization of events during this period, regardless of their nature—whether governmental, artistic, scientific, or commercial. In cases where the cancellation of the event was not feasible, the recommendation was to conduct it without the physical presence of an audience. There was also guidance for event organizers that could not be effectively canceled; they should establish communication with health authorities to comply with the requirements provided for in the legislation for such circumstances.

The "delays in thesis/dissertation defense/qualification exams" were the third most indicated occurrence by faculty members. Such delays were endorsed by academic authorities and research bodies, including Fapesp (2020), which issued a measure extending the validity period of all scholarships in the country by 60 days, affected by institutional initiatives to interrupt activities due to Covid-19 events.

It is also noted that higher education institutions hosting the programs/courses implemented measures related to deadlines in accordance with the guidelines issued by Capes – Coordination for the Improvement of Higher Education Personnel.

The need to "revise proposals for ongoing studies" and "redo research methodologies and data collection procedures/processes" was also pointed out, reflecting the challenges faced to maintain the quality of research and ensure its

development without the risk of losses for students and faculty. In this sense, the revisions made responded to the requirements of data collection locations, as well as the type of study being developed, prioritizing research methods that do not require in-person human contact.

This need was also supported by guidelines from the Ministry of Health (2020), which expanded individual recommendations regarding preventive measures against disease contamination. These guidelines were to be incorporated by schools, industries, businesses, and commercial establishments, made available on websites, and directly shared with their respective audiences. The Ministry shared a variety of other guidelines with state and municipal managers, covering changes in urban circulation patterns, adjustments to work routines, modifications to the school calendar, and approaches to dealing with suspected, confirmed, and fatal cases of the disease.

It was also noted, with a low level of response indication, the repercussion "loss of a member of the program/course/research group/research project." Also, with a low percentage of responses, "difficulty in complying with new protocols for access to laboratories, companies/institutions, participants, and other items related to research" and the need for "goal revision" were indicated. The "discontinuity in the flow of financial resources for research/projects" was also mentioned by faculty, but at a low occurrence level, showing that such a repercussion did not result in losses, discontinuities, or suspension of research.

Authors Oliveira e Silva (2021) emphasize the breadth of the negative consequences caused by the difficulties faced by faculty members. This demonstrates how the interconnection between various elements of the educational environment can generate cascading effects, affecting not only the quality of teaching but also interpersonal relationships and the health of teachers. For them, the mental health of teachers is a crucial aspect to be considered in the context of education because it directly influences their ability to provide a healthy and effective learning environment for students.

Collectively, these results offer a comprehensive view of the main implications of the pandemic on the academic-scientific activities of postgraduate faculty in Production Engineering in the Southeast region of Brazil, highlighting both the challenges faced and the strategies adopted to address them.

4. Conclusion

The article presented part of the results of a study that investigated the impacts of the pandemic on the academic activities of faculty members. The main occurrences that reverberated in the context of teaching, research, extension activities, as well as the need for adaptations, changes, and revisions in the schedules and work agenda of students/faculty, and other related occurrences, were observed and discussed.

When analyzing the responses of faculty members regarding the consequences of the pandemic on academic-scientific activities, it became clear that the most perceived by them was the distancing from the work environment, especially from the people with whom they develop professional and, to some extent, affective interpersonal relationships. It is evident that work conducted outside their natural environment (within the Higher Education Institution) was widely practiced by the postgraduate programs participating in the study. It continued to operate, receiving possible adaptations and adjustments, and was carried out in a family and/or residential setting.

It was also noted that no adverse repercussions affecting faculty members were identified in terms of deadlines and financial resources. The programs/courses, guided by higher authorities, were compelled to flex their regulations and deadline schedules.

However, changes occurred in the methods and methodological procedures of ongoing study proposals (theses/dissertations) since these were associated with the external data collection process or types of studies that could only be

conducted in the actual environment where the research phenomena manifested, especially in applied research.

Given the imposition of protective measures, supported by the government, as well as the globally affected context, it is understandable that there was no "loss of productivity scholarship status" for any faculty member.

A recommendation for studies interested in observing the impacts of the Covid-19 pandemic on teaching work is to delve into the investigation of the adaptation and resilience strategies adopted by faculty members in the face of the challenges identified in this context. This specificity could yield interesting considerations related to the mental/psychological/emotional health of faculty members, as well as the precariousness of teaching work exacerbated by the implications of external events, such as the Covid-19 pandemic.

The study establishes a connection with research focused on teaching in the field of Production Engineering, specifically in the context of the Covid-19 pandemic.

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