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TECHNOLOGY AND INNOVATION IN PROFESSIONAL EDUCATION: A CRITICAL ANALYSIS

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ABSTRACT

This study aims to analyze the psychosocial effects gained by technology and innovation areas nowadays, as well as their impacts on professional education. To this end, this research includes a brief historical overview in which we present how elements of technological innovation produce local and historical effects that guide contemporary urban life. The empirical section presents a descriptive qualitative study that includes statements from five engineering professors who work at a public university located in the interior of the state of Paraná, Brazil. The results indicate that engineering is connected to prescriptions focused on work performance and the endorsement of technology use in daily life. Thus, it remains distant from a critical analysis of the psychosocial effects brought about by technological innovations, particularly concerning job placement. As a partial conclusion, we highlight that practices related to technology and innovation meet the demands of different types of populations, companies, and governments, reinforcing their relevance for social organization. At the same time, it is evident that the area lacks a critical analysis regarding its actions in the sphere of social inclusion and exclusion.

Keywords: technology; innovation; engineering; subjectivity; professional education

Tecnología e innovación en la formación profesional: un análisis crítico

RESUMEN

El objetivo de este estudio consiste en analizar los efectos psicosociales que las áreas de tecnología e innovación ganaron en la actualidad, así como sus impactos en la formación profesional. Para tanto, la investigación cuenta con un breve rescate histórico en el cual presentamos como los elementos de la innovación tecnológica producen efectos locales e históricos que se vuelvan orientadores de la vida urbana contemporánea. La parte empírica presenta un estudio cualitativo descriptivo que cuenta con testimonios de cinco docentes ingenieros que actúan en una universidad pública federal localizada en el interior del estado de Paraná. Los resultados apuntan que esa área es conectada a las prescripciones volcadas al desempeño laboral y al reconocimiento del uso de la tecnología en el cotidiano. Con eso, ella se queda distante de un análisis crítico sobre los efectos psicosociales traídos por tales aplicaciones, especialmente en lo que se refiere a la colocación profesional. Como conclusión parcial, se pone de relieve que las prácticas volcadas a la tecnología y la innovación atenden a las demandas de populaciones, empresariales y gubernamentales de distintos tipos, reafirmando su importancia para a organización social. A la vez, se volvió evidente lo cuanto el área necesita de un análisis crítico acerca de sus acciones en la esfera de la inclusión y exclusión sociales.

Palabras clave: tecnología; innovación; ingeniería; subjetividad; formación profesional

Tecnologia e inovação na formação profissional: uma análise crítica

RESUMO

O objetivo deste estudo consiste em analisar os efeitos psicossociais que as áreas de tecnologia e inovação ganharam na atualidade bem como seus impactos na formação profissional. Para tanto, a pesquisa conta com um breve resgate histórico no qual apresentamos como os elementos da inovação tecnológica produzem efeitos locais e históricos que se tornam norteadores da vida urbana contemporânea. A parte empírica apresenta um estudo qualitativo descritivo que conta com depoimentos de cinco docentes engenheiros que atuam em uma universidade pública federal localizada no interior do estado do Paraná. Os resultados demonstram que essa área é conectada às prescrições voltadas ao desempenho laboral e ao enaltecimento do uso da tecnologia no cotidiano. Com isso, ela fica distante de uma análise crítica sobre os efeitos psicossociais trazidos por tais aplicações, especialmente no que se refere à colocação profissional. Como conclusão parcial, destaca-se que as práticas voltadas para a tecnologia e a inovação atendem a demandas populacionais, empresariais e governamentais de diferentes tipos, reafirmando sua importância para a organização social. Ao mesmo tempo, tornou-se evidente o quanto a área carece de uma análise crítica acerca de suas ações na esfera da inclusão e exclusão sociais.

Palavras-chave: tecnologia; inovação; engenharia; subjetividade; formação profissional

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INTRODUCTION

The use of tools and equipment that facilitate daily life has become more prominent, with areas of knowledge dedicated to technology's systematic improvement. In a philosophical sense, Lévy (1999, p. 28) defines technology as "the multifaceted activity of human groups, a complex collective becoming that crystallizes mainly around material objects, computer programs, and communication devices". This activity is articulated in the production of knowledge, equipment, and services, and is accompanied by another dimension: innovation. It is seen as a product or process "that can result in improvements and effective quality or performance gains" (Brasil, 2016, p. 2).

Lévy (1999) further emphasizes that the development of new technologies is something essentially social, and it is worth highlighting how its advancement, directly linked to innovation, has been explored with the Internet. Firstly, it is important to consider that this computer network follows the assumptions of capitalist socio-economic development, disseminating the idea that social progress, connected to technology, is something linear, accessible, and well-defined (Hardt & Negri, 2001). In this sense, in addition to government spheres, global companies adhere to the diffusion and advancement of technology, highlighting its relevance in international debates in the promotion of social progress and global sustainability (UN, 2015). With this incentive, inter-institutional networks committed to producing knowledge aimed at technological innovation are formed, giving special attention to professional education.

In line with this appreciation, recent studies (Phan & Ngo, 2020; Labzina; Dobrova; Menshenina & Ageenko, 2019; Oliveira & Moraes, 2016) demonstrate that expanding technological professionalization and developing more efficient equipment and processes require partnerships. In this sense, Brazilian authorities state that technology development should be articulated with global economic policies (MEC, 2005). Higher Education Institutions (HEIs) are responsible for generating and implementing projects focused on science, technology, and innovation, whose results are required by industries and impact the population's daily life.

Considering this scenario that brings diverse organizations together to promote technological production in industries, this research aims to analyze the psychosocial effects gained by technology and innovation areas nowadays, as well as their impacts on professional education. We consider psychosocial effects as the plurality of practices performed in different social institutions, which significantly interfere with the population's ways of life (Sawaia, 2001).

In the first section, this study presents a brief historical and critical discussion about the consolidation of technological innovation in Brazil, especially in professional education. Then, statements from higher technological education professors, who were invited to report on the social, ethical, and political effects on the education of electrical engineers, will be presented and analyzed. Finally, it will be possible to demonstrate that technology and innovation are part of everyday life and are widely recognized and valued in daily routines. At the same time, the study reveals that this often unconditional valorization hinders a critical analysis of the psychosocial effects of social exclusion, especially in the labor sphere.

A BRIEF HISTORICAL TRAJECTORY OF THE CONSOLIDATION OF TECHNOLOGY AND INNOVATION IN BRAZIL

A survey conducted by the Center for Strategic Studies and Management (CGEE) showed that more than 70% of respondents considered that science and technology bring only benefits or more benefits than harm to society (CGEE, 2019). This evaluation, coupled with the use of various technological equipment, applications, and services, reveals how science and technology have entered not only the daily life of productive organizations but also the population's daily routines. To some extent, the recurrent use of technology and innovation in different social spaces makes them seen as necessary and indispensable to social functioning, being widely used in different situations and posing new dilemmas to be appreciated (Tavares & Gomes, 2017). Thus, we ask: how was the use of both technology and innovation traced and consolidated in such a way that they became indispensable to society?

Foucault's studies (2019) on the notion of truth have contributed to understanding this scenario. According to the author, truth is produced through a long and multifaceted historical process that is constantly changing and involves the population's adherence. Foucault emphasizes that "truth is a thing of this world: it is produced only by virtue of multiple forms of constraint. And it induces regular effects of power. Each society has its regime of truth, its 'general politics' of truth" (Foucault, 2019, p. 52). What occurs in everyday life in society is an approximation of the "scientific discourse" (Foucault, 2019, p. 52) with the population's daily life, through the integration of technology and innovation in different activities. One example is urban mobility, which has been reorganized more recently due to transportation applications that offer an alternative form of income. The number of people working in private vehicles increased and reached 3.6 million in Brazil in 2018 (IBGE, 2019). Another example is the widespread use of instant messaging applications. According to Oliveira (2018), over half of the population used these applications in Brazil in 2018. This adherence is also evident in the consolidation of Distance Learning (DL), whose expansion in recent years (INEP, 2019) has gained

prominence, reaching a total of 9.3 million enrollments in distance, semi-presential, and free courses in 2018 (ABED, 2019).

These examples reflect the dissemination of technological knowledge that emerges "from power relations, strategic developments, and tactics" (Foucault, 2019, p. 41) aimed at promoting solutions that facilitate life in society. According to Foucault (2019), the production of systems of appreciation occurs amid regimes of truth supported by the dissemination of scientific statements, more precisely in the construction of a set of statements with effects of truth that disseminate, with a scientific basis, the importance of acquiring technology and using innovation in the general organization of everyday life.

Foucault (2019) emphasizes that knowledge is constituted in power relations. Governmentality can be understood as a form of power that "led to the development of a series of specific apparatuses of government and a set of knowledge" (p. 429). This perspective suggests how a certain production of knowledge can gain importance in the social dynamic by being part of a government of the population, which systematically invests in the dissemination of technological innovations, producing psychosocial effects. How does this occur in the thematic context of this research? In Brazil, the articulation between science and technology with an emphasis on innovation dates back to the National Conference on Science Technology and Innovation (2001), which outlined the goal of "broadening the innovation capacity and expanding the national scientific and technological base" (Brazil, 2002, p. 36). The following years were marked by projects aimed at creating and expanding technical and higher education centers focused on technological development (MEC, 2005; Brasil, 2008).

For Foucault (2019), the production of knowledge in a society, with its effects of truth, "is subject to constant economic and political incitement" (p. 52). Thus, the development of the technological area involves conflicts of interest encompassing economic, social, environmental, relational, and even political spheres. An example of this was the enactment of Law 13,243/2016, which aimed to facilitate integration between the Brazilian government, universities, research centers, and private sectors to "meet the priorities of national industrial and technological policies" (Brazil, 2016, p. 1). This integration led to areas of knowledge more influenced by technology and innovation favoring a "connection and interaction with business, government, and society itself" (Audy, 2017, p. 86), starting from the academic education process.

Foucault (2019) emphasizes that knowledge is fundamentally social, the product of confrontations and diverse interests. When instrumentalized, with an economic bias, it serves to decrease costs and increase profits, demonstrating how much the language and the market values impact the educational sphere. According to Mattos and Fernandes (2023), envisioning an overcoming of market dictates that cross the production of knowledge in universities implies combating the "meritocratic ideology" (p. 15), which tends to reinforce "academic productivism" (p. 15) in its favored areas. This situation unfolds in "teaching practices, which tend to lead teachers to invest more in research activities, which are more profitable in the field, than in pedagogical practices" (Mattos & Fernandes, 2023, p. 15).

Thus, we arrive at another interface between the government and the production of truths related to technological innovation, which brings market interests into play. Lazzarato (2017, p. 168) highlights that governmentality, in this case, "occurs as a set of techniques that cannot be exclusively attributed to the government." It circulates in the social field and gains expression in "some political or economic apparatuses (Universities, Army, writing, media)" (Foucault, 2019, p. 52). The media is a significant vector in the production, dissemination, and maintenance of discourses, knowledge, and truths about technology and innovation:

> The world never stops changing. Every year, every month, every day, something new emerges, evolves, improves. Communication becomes faster. The devices become smaller, more powerful, smarter. Production becomes increasingly efficient and sustainable (...). All of this has a name, innovation. Innovation changes everything, it changes everyone (Inovação, 2019, n/a).

This advertising message allows us to glimpse a scenario of changes and transformations marked by the pursuit of the new, as long as it is inscribed in the circuit of commodity production. These changes and transformations are linked to improvements in different dimensions of contemporary existence, facilitating the adherence of different population groups that recognize and use its products, as long as they are included in the consumption circuit. The emergence of issues related to the exploitation of nature, the labor sphere, consumption, and personal life, is placed at the interface with innovation, popularizing the efficiency of these advances. As a result, processes of exclusion gain visibility and are multifaceted, involving "material, political, relational, and subjective dimensions" (Sawaia 2001, p. 9).

Alongside the advertising strategy, governmentality becomes preponderant in constituting political and economic conditions of diffusion in this area, providing consistency to the production of subjects directly connected with their historical context and in accordance with their relations (Foucault, 2019). In a broader sense, Guattari and Rolnik (1996, p. 33) point out that

subjectivity "is essentially social, and assumed and lived by individuals in their particular existences." The authors mention that the processes of subjectivation are produced amidst elements in circulation during each historical moment and, according to the present study, they involve the valorization of technological development as a promoter of solutions to the diverse impasses emerging in the social fabric.

Thus, it is possible to observe that the alliance between governments, research institutions, and the market has historically cooperated to disseminate technological innovations among a population that embraced their benefits without engaging in a more critical analysis of the effects of unemployment (Forrester, 1997) and social exclusion (Sawaia, 2001), for example. For Sawaia and Figueiredo (2019), social exclusion, so present in daily life, including in higher education, "closes the future and prevents the opening of horizons, access to education and health, fosters injustices, reinforces individualism and trivialization of the harms caused to men and nature, and blame individuals and groups for their own misfortune" (p. 666).

Faced with the growing articulation between universities and companies, strongly promoted by the emphasis on technology and innovation, the agents within higher education encounter the challenge of discussing "the role of public universities in building a fairer and a more just and democratic society" (Oliveira & Moraes, 2016, p. 91). Now, it is important to understand how workers dedicated to teaching in the engineering technology area perceive their role in the education of professionals who will work in a market increasingly focused on technological innovation.

METHODOLOGICAL CONSIDERATIONS ABOUT THE EMPIRICAL SECTION

In the empirical section, of qualitative and descriptive nature, Minayo's (2001) perspective was adopted, stressing the importance of "understanding and explaining the dynamics of social relations [...] depository of beliefs, values, attitudes, and habits" (p. 24). The author emphasizes that this type of research works "with living experience, with everyday life, and also with the understanding of structures and institutions as results of objectified human action" (p. 24).

The empirical section of this research was initiated after its approval by the Ethics Committee for Research with Human Beings and the signature of the Terms of Consent by the participants. The names of the interviewees were altered to ensure confidentiality regarding their identification. The initial contact with the participants was via e-mail, providing an explanation of the research objectives and an invitation to participate. After acceptance, data collection was conducted remotely using the Meet platform, as the Covid-19 pandemic and its social distancing measures were already enacted at the time of the survey.

The five participants reported being male, aged between 38 and 45 years old, with an employment relationship at the time of the research, and working as professors in the engineering course of a federal public technological university located in the state of Paraná, Brazil. The participants had a minimum of seven years of experience in the educational field and taught technology-related disciplines, such as Electronics, Control and Automation Techniques, Microcontrollers, Electrical Machines, and Signal Analysis.

Three inclusion criteria were defined: the professors should hold a Bachelor's degree and a PhD in the engineering area, have been working as a professor for at least five years at this institution, and maintain a direct link to technology and innovation in their teaching practice, authoring works recognized by the area and registered in their curricula.

Semi-structured interview was used as a data collection instrument to assess the participants' perspectives on values, professional education, and connections within the area. The themes addressed in the interviews were: the professors' connection to technology and education, the main difficulties and facilities of educational practice in the area, the values that guide the teaching of technology, the effects of technology and innovation on the education of professionals and on the daily life of the population, and the ethical perception of the transformations arising from technology in relation to the current social organization.

The statements were arranged and analyzed in two thematic axes: 1) General requirements for working in the area; and 2) Shared values in the area. This analytical approach seeks to "group elements, ideas, or expressions around a concept capable of encompassing all of this" (Gomes, 2001, p. 70). Gomes (2001) suggests that categories should be constructed "based on a single classification principle" (p. 72), allowing "the inclusion of any response in one of the categories of the set" (p. 72). Based on these premises, in the first axis, the main requirements involved in the learning processes indicated by the participants were analyzed. In the second axis, the values, ideas, desires, and goals that underpin the work in the area were analyzed.

RESULTS: TECHNOLOGY AND INNOVATION IN THE DAILY WORK OF ENGINEERS

The importance gained by technology and innovation in academia, in companies, and in people's lives is evidenced in the statements presented. The results and analyses bring visibility to the values present in the education of professionals who intervene in social daily life using technology and innovation.

Axis 1: General requirements to work in the area

Giving visibility to the requirements considered necessary to work in the technology area implies

highlighting the ways of acting, thinking, seeing, and positioning oneself in the world according to the interviewees' perspective. Thus, Lucas highlights the relevance of the will to learn, which, for him, is related to the willingness to seek new knowledge. The professor mentions, "*in terms of research, I had many good cases. The students who came to talk to me had no basis at all, but when they came to work with me, they did a wonderful, brilliant job because they went after learning the things they didn't know*" (Lucas, participant, 2020). For Lucas, the will to learn refers to actively searching for information and knowledge that resonate with another relevant subjective component reported by Pedro, curiosity. The professor states:

> *If he [the student] keeps his curiosity sharp, he will certainly see conditions in nature, in everyday life, that can be improved. If he can see a condition and looks for how to solve that condition, he generates one, and if no one has done that before, he creates an innovation. He generates something that he can change in people's lives. I think the most important thing is curiosity. Students have to be curious, if you are not curious to know how things work, it is difficult to be interested in working a little more.* (Pedro)

Lucas and Pedro show that to generate innovations, it is essential for learners and professionals to maintain the will to learn and curiosity in their daily activities. However, how is it possible to maintain this degree of involvement with learning in a social context that, as mentioned in the theoretical section of this study, is permeated by the naturalization of a truth, social inequalities, and processes of exclusion? By relating the 'will to learn' to 'curiosity', the professors present a specific way of "perceiving the world" (Guattari & Rolnik, 1996, p. 27), focused on individual commitment (Lazzarato, 2017). In this sense, Roberto points out that resilience is necessary to overcome adversities encountered when implementing projects in the industrial field. According to him:

> [...] *things cannot fail. A ventilator cannot display a blue screen error, a pacemaker cannot crash. There is a gap between just making the solution and it being feasible to be applied in people's daily lives and everything else. So, engineers will have to make these analyses very carefully, and it will demand a lot from them in this sense. I can say that my discipline demands a lot of this resilience. You work hard and have very few moments of happiness, it takes a long time for you to smile a little because it is not very glamorous, it is a fact of engineering. Engineering is a colder thing. What I am saying seems cruel, but it's a fact.* (Roberto)

Resilience was linked to the individual's ability to overcome difficulties present in the different stages of product creation, whose operation does not admit failures and demands waiting to achieve results in engineering. The production of a truth (Foucault, 2019) about technology, disseminated as something easy and accessible, goes through a long way of elaboration that, when disregarded, creates a gap between the practices performed at the university and the public recognition of the final product. This can create dissatisfaction and distress in both the learners (Mattos & Fernandes, 2023) and the users (Audy, 2017). Given this scenario, Fernando mentions: "*So, things go wrong, you have to pick up, do it again. And so you can't throw in the towel*" (Fernando, participant, 2020). However, Fernando reports that resilience is "*a characteristic that we are, unfortunately, losing over time*" (Fernando, participant, 2020). The professor explains:

> *And when they [the students] arrive unprepared for university, it is very common for them to have difficulties because the environment is totally different. And see, I am talking about the students targeted by affirmative policies who suffer a little bit more, but even the other students from private schools suffer too. The big issue here is the nature of the distress. It makes a difference because some have a slightly better base. He [the student] will have to study, but the guy often manages to get through it more easily. Others have to study a lot, they end up giving up and that's really bad. As it is passed on from generation to generation, they become less resilient. They abandon the dream more easily.* (Fernando)

In recent years, the average income of university entrants has decreased (INEP, 2019), which, according to Fernando, is related to an increase in students' distress during undergraduate courses, which leads to a decrease in resilience. Fernando adds: "*Some people can't do it, some people start to get stuck*" (Fernando, participant, 2020). In this sense, Tavares and Gomes (2017) highlight the "enormous gap" that separates students, educational institutions, and market demands, showing that institutional policies coexist with "several difficult dilemmas to solve" (p. 647).

In an attempt to face this situation, Fernando says that the university has modified introductory classes in favor of contents considered essential for the technological area. However, according to him, this does not prevent student distress and a high dropout rate, leaving undergraduates at an impasse. Thus, students who "get stuck" find it difficult to adhere to a competition with themselves and with their education, according to the demands set by the field. The interviewee stresses the importance of committing to the studies, explaining: "*The study part is going well, the students are studying*" (Fernando, participant, 2020). However, as mentioned

in the theoretical section of this study, by disregarding social problems, mainly related to social exclusion, "each one then believes (is encouraged to believe) themself to be a failed master of their own destiny, when they were nothing more than a number placed by chance in a statistic" (Forrester, 1997, p. 10).

José emphasizes the importance of another requirement for training and working in the area: being receptive to learning new technologies:

> *As things change very fast, we can't stay closed and we have to be constantly learning for this very reason, to be looking for technologies and seeing whether it is worth switching to them. Efficiency, in this technological aspect, has a lot to do with speed, how fast you can cater to this new technology that has emerged.* (José)

The receptivity and adherence to technology and innovation, when associated with a socially legitimized truth in components of subjectivation that circulate in the social (Foucault, 2019), gain relevance by linking the pace of innovations in the market to the pace of new technology consumption by the population. Thus, the practice of connecting the labor forces and consumption "to the imperative of not slowing down, of not wasting time" (Stengers, 2019, p. 14) is disseminated. Fernando endorses this idea as he believes it is necessary to have the "*initiative to look for new technologies. You can't wait around too long*" (Fernando, participant, 2020). In contrast to the rapid production speed, Lucas reports that it is not possible to be aware of all the technological transformations used in the industry. The interviewee says: "*as a professor, I perhaps end up falling behind a bit on which new technologies are out there. We end up not being very up-to-date*" (Lucas, participant, 2020). Hence the need, according to José, to establish bonds of cooperation based on good communication. The professor reports: "*As it changes very fast, knowing how to interact with colleagues and looking for other professionals to meet these demands is also important because there is not enough time for people to go after it themselves*" (José, participant, 2020).

The components of subjectivization cited by José, value "the production of knowledge and social contacts. This type of [immaterial] production also incorporates imagination, intelligence, and cooperation" (Mansano & Carvalho, 2015, p. 658). These dimensions connect with another requirement in the labor sphere mentioned by Roberto, which involves what he calls analytical capacity:

> *The analytical capacity, the idea of analyzing the situation you are dealing with... If you did something and it didn't work, you analyze the experiences you've had, collect, improve the process, and try to come up with a solution as soon as possible, learn from your mistakes or, instead of learning from your mistakes, research and find out what has already happened to other people to avoid making the same mistake too.* (Roberto)

In this perspective, the analytical capacity is aligned with a more rational, directed, and "cold" pragmatic conduct, an aspect that, for Lazzarato (2017), promotes a mechanical functioning in the work practice of these professionals, leaving no room for a critical and situated analysis of the effects of productivity on the population's life and on the field worker's life. Fernando reports situations that he didn't appreciate in his experience in the industry: "*You have fixed working hours, you can't exchange many ideas about life. It was a very technical thing, it was a much colder thing*" (Fernando, participant, 2020). In this sense, Roberto mentions:

> *So there is the focus necessary to, even in the face of various problems that will occur... Unfortunately or fortunately, that's a part of the world, especially in the industry. Knowing how to deal with it will increase your resilience and make the person grow in the activity they set out to do.* (Roberto)

Keeping the focus on production, regardless of the problems present in the project development, refers to the disciplined fulfillment of routine work activities. The valorization of analytical capacity and focus spreads a model of worker and student that resembles "mechanical parts, constituting 'human' components and elements of the machinery" (Lazzarato, 2017, p. 173). The diffusion of such functioning, according to Lucas, is present in the university where he works: "*I think many colleagues see the student there as: 'The guy got a zero, he's useless'. You don't have a, 'Why did this happen? What might be going on?' I think there is a lack of humanization in the university*" (Lucas). This situation opens up spaces, once again, for processes of exclusion, in which the affective bond with education can be "invisibilized, devalued, rendered nonexistent" (Santos & Mendes, 2018, p. 15), which hinders the learning and connection processes.

Analyzing the obstacles to students' retention in universities, Mattos and Fernandes (2023, p. 17) state that "academic difficulties and pedagogical practice present an important unfolding, especially because they are determining factors for passing disciplines and progressing in courses. As reported by the participants, the incessant demand for production and performance is maintained in spite of affective, economic, and social impasses, as will be presented subsequently.

Axis 2: Shared values in the area

In this section, the values disseminated in the area that generate various "specific effects of power" (Foucault, 2019, p. 53) will be presented. The accessibility and availability of information resulting from the use of smartphones, internet, and applications in the population's daily life are dimensions highlighted by

Lucas, who states: "*Nowadays, technology and the access to information are much more available. For example, a smartphone incorporates many functions. This is a result of technology research*" (Lucas). From this perspective, access to equipment and the Internet gains prominence in knowledge possession. Roberto points out: "*Look how interesting, even far from an educational center, with information technology you can access this education and improve your knowledge and everything else. You universalize education*" (Roberto, participant, 2020). Thus, the advancement of telecommunications and the proliferation of technological equipment consumption favor the assessment necessary to expand facilitated access to education.

The acceptance and legitimization of this statement as a truth (Foucault, 2019) minimizes, as one of its effects, existing impasses in the social field of higher education and job placement in the labor market (Mattos & Fernandes, 2023). From this perspective, education ends up being confused with only acquiring information, which is different from knowledge production and approaches, as Stengers (2019) mentions, a rapid professional education. Concomitantly, the need for a proactive search for knowledge, in which the individual "is consigned not only to competition with others but also to competition with oneself" (Lazzarato, 2017, p. 175), is disseminated. In this regard, Pedro emphasizes individual commitment when he points out: "*The information is available. So, if you have perseverance, you can, generally speaking, transform the information into knowledge*" (Pedro).

Since access to information is considered easy and broad, the participants emphasize the relevance of commitment to its search, and thus spreading the idea that individuals possess the necessary conditions to freely conduct their own professional improvement. This occurs despite the pressures and difficulties present in both professional education and practice. The production of this component of individualistic subjectivation is endorsed by José, who, regarding continuous learning, points out: "*As we have more access to information, with technology you can study, learn, and see how the world works. You can do it, if you have the will and are open-minded*" (José). For José, based on the student's will and openness, it is possible to broaden the understanding of how the technological world works. This engagement, based on the mobilization of such elements, can, according to Lazzarato (2017), make each person "a 'subject' responsible and culpable for their own 'actions' and 'behaviors'. The 'free subject' [...] is fulfilled in the figure of the self-entrepreneur and in the figure of the consumer who chooses in a 'sovereign' manner amidst an infinite panoply of commodities" (Lazzarato, 2017, p. 172). Given the diffusion of information's easy access and availability, Roberto reports:

> […] [with] *the enormous amount of information, people, and I include myself, seem to feel more pressured to know everything that is happening in the best possible way. Life used to be simpler. Why? Because you didn't need to know, to be aware of so many things. Today they know and, at the same time, they don't know very well what to do with it.* (Roberto)

Given the availability of information, Roberto believes that everyone is responsible for their access and use of it to achieve and maintain a job placement. Such assumption works, according to Guattari and Rolnik (1996), as an imaginary frame of reference, in which anyone could access information according to their interest. When placing his perceptions within this referential, Roberto alludes to two components of subjectivation pointed out by Guattari and Rolnik (1996): segregation and guilt. Both alternate in his speech, which, on the one hand, points out the continuous separation between people who know how to use this knowledge in their daily lives and, on the other hand, highlights the guilt arising from the demand to be fully informed about the events happening around himself. Fernando (2020) reports: "*Whatever industry you will work in, you will be paid to suggest alternatives, to improve, to optimize the process. To do this, you have to study. Otherwise, it is unlikely that you will keep your job*".

For the interviewee, the ability to optimize production processes and generate profit is tied to continuous study and can result in engineers getting and maintaining jobs. Such instability is confirmed by Roberto who points out: "*I understand that the comfort zone today is much smaller than it used to be because innovation, especially technological innovation, changes quickly, which didn't happen that much before. People are always recycling themselves*" (Roberto). The speed of technological transformations and the instability, pointed out by Roberto, reinforce the demand for permanent learning. One of the effects of this scenario is that the professional "leaves the condition of a merely docile and obedient worker to assume the condition of 'participant and responsible'" (Mansano & Carvalho, 2015, p. 657) for an education that is not concluded while they are connected to the labor market. In this process, the worker becomes, as Lazzarato (2017, p. 175) mentions, "his first judge," willing to make new judgments and set new goals to be achieved despite the installed unemployment scenario. Mattos and Fernandes (2023) point out: "Student retention in university involves other dimensions besides financial aid actions. Students understand and experience symbolic factors that may influence whether they stay or drop out of university" (p. 17). Such symbolic factors range from inclusion policies to affections and social bonds experienced in the classroom's daily life. When faced with the classroom model's disruption that

occurred due to the Covid-19 pandemic, Roberto reports that he was scared to face a new work methodology. The professor states:

> *Recording the lessons, many found it much better than the face-to-face mode, because the opportunity to watch the lessons later and clear up any doubts they hadn't understood at the time was great. For me, I didn't expect this feedback, because it's kind of scary. We don't have the proper training and we have to teach the discipline in a new format.* (Roberto)

For Roberto, the new facilities arising from communication technologies applied to education have led to a high rate of acceptance of digital learning platforms, which stands out as something that greatly facilitates professional education. Another effect that results from easier access to information was the change in time perception. In this regard, Roberto explains:

> *People learn faster, do things faster, and thus tend to feel pressured to be more productive. It's a more productive world in terms of competitiveness and everything else. As the workers' life has changed, in this sense, with technological innovations, I think they are under more pressure. Why? Because they have faster access to the information they need.* (Roberto)

Stengers (2019) points out that due to the expansion and popularization of computer science, the relationships between learning and producing technical knowledge, linked to practical uses, tend to generate a "movement, where the imperative is to go as fast as possible" (p. 14). In this regard, Roberto reports his expectation that learning speed, results, and productivity will be greater. However, alluding to his daily life in teaching, Roberto notes, "*People have different learning speeds and I think that should be respected*" (Roberto). Pedro explores another angle of temporality. According to him:

> *There is a restlessness of not being able to wait the necessary time to transform information into knowledge. Today, I realize that there is much more interest in the result than in the learning process, and this goes a bit against the perspective I have at the university. Students at university are not engineering professionals yet. Something that I think you need to have to become an engineer, work with technology, besides curiosity and perseverance, is patience.* (Pedro).

Comparing different generations, Pedro highlights the tension in professional education. In some moments, students are expected to be more efficient and, as mentioned by José and Roberto, faster in the learning process; in other moments, they are understood as hasty, connected only to the search for results, as pointed out by Pedro. Both cases give visibility to the education of a professional who shifts between production speed and learning patience. José argues that the possibility of shortening distances through the advance of transport and communication technologies has given support to a worldwide dispute:

> *This reduction in distance and the ease of communication end up creating pressure on people and in society for speed and efficiency, which generates a lot of stress. So that has a harmful effect, this harmful aspect of the stress brought by technology, there are advantages and disadvantages. There is no generation out there as stressed and depressed as the current one, that's why depression is one of the great diseases of the 21st century.* (José).

The perception of the effects of competition on a generation of students goes along with what Lazzarato states: "The 'disease' of the 21st century manifests itself in 'depression': impotence to act, impotence to decide, and impotence to undertake projects; passive and individual resistance to the general mobilization and the order of being active, having projects, and getting involved" (Lazzarato, 2017, p. 176). This scenario, as exposed, can lead to a decrease in the quality of life of both teachers and students during their education path in university. Thus, the situation indicates a pressing need for attention to health and well-being in teaching and learning processes (Anversa, Santos Filha, Silva & Fedosse, 2018).

At the end of this axis's presentation, we can consider that the values disseminated in the area, from the participants' perspective, highlight the facilities and difficulties of accessing information present on the Internet, generating effects that make the subjects responsible for the success of their education.

FINAL CONSIDERATIONS

During this research, which aimed to analyze the psychosocial effects that technology and innovation areas have gained nowadays, as well as their impacts on professional education, it was possible to demonstrate the constitution of values that generated effects of truth about technology and innovation in contemporaneity. At the end of this trajectory, the research has come to some findings. Firstly, it was noticeable that the process of transforming technology into a new reference of truth involved executing several government, advertising, and business strategies that disseminated its importance among the population, favoring the idea that technological innovations would be widely accessible.

Secondly, we highlight a socially shared tendency to perceive access and availability of information and education as unrestricted, which emphasizes the student's individual responsibility to remain active and open to new technologies in professional practice. This implies knowing and accessing the latest technological

releases and meeting the demand for permanent training. This unfolds in the adherence to rapid obsolescence and consumption of products and services, which can also be seen in learning strategies. Thus, even if there are learning impasses, it is these professionals' responsibility to manage their access to knowledge, which makes it possible, according to the participants, to keep their jobs.

Thirdly, the results point to another side of the psychosocial effects of high speed on the lives of these students and workers. Exhaustion is detected in the difficulty of keeping up with technological innovations, in the distress of not knowing what is new in the market, and in the discomfort of being exposed to short-term demands. Thus, the interviewees demonstrate that this excess engenders social effects that lead professionals to exhaustion, sometimes expressed in psychological suffering, such as depression, stress, and panic. The severity of this situation indicates a field for future research, which articulates technology and innovation areas and the processes of illness present in these professionals' relational and educational daily life.

As a partial conclusion, the challenge posed to professors in the area is evident: to dedicate themselves to the analysis of the psychosocial effects generated by technology and innovation endorsement, considering both their benefits and the impasses they engender in the daily lives of students, professionals, and the population.

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