EDUCATION AND TECHNOLOGY IN THE TWENTY-FIRST CENTURY: CRITICAL ISSUES IN THE RELATIONS OF TEACHING AND LEARNING

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ABSTRACT

The integration of technology in education has consolidated itself as a definitive feature of the twenty-first century, reconfiguring the paradigms of teaching and learning. This article investigates critical issues at the intersection of education and technology, with an emphasis on the hybridity of pedagogical approaches, the disruptive impact of the COVID-19 pandemic on remote teaching, and the ethical dilemmas of artificial intelligence (AI) applied to education. It analyzes the role of digital artifacts, cyberculture and socio-cognitive skills in contemporary education, problematizing the polarization between technophiles and technophobes. The study highlights both the opportunities and limits of digital tools, advocating equitable access, critical digital literacy, and human-centered technological integration models.

Keywords: Education. Technology. Hybridism. Artificial intelligence. Cyberculture.

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INTRODUCTION

The use of technologies in pedagogical activities are practices carried out since immemorial periods. Both technologies, whether analog or more recently digital, and their artifacts have undergone transformations in their conceptions, uses and meanings in their appropriations in learning spaces.

The main objective of this text will be to carry out a brief discussion between what is understood as education and the use of technologies in classrooms, technological artifacts and the influences of political discourses related to the theme under study and to technologies between the end of the twentieth century and the twenty-first century.

We understand that the themes on the use of technologies have many strands, with the hegemonic philosophical currents being favorable known by technophiles, those contrary by technophobes and those that position themselves as critical, that is, without openly taking sides with one or the other. (PEDROSA; COAST; MAMEDE-NEVES, 2021)

The physical and virtual spaces in which technologies are appropriated, especially cyberspace (LEMOS, 2007), a virtual space in which social, professional, pedagogical and entertainment relationships take place, have gained notoriety in the present century from the optimization of internet resources, the improvement of digital resources and optimized network connectivity.

Thinking about the issues of the use of cyberspace, its devices, the analog and digital relations built (or not) between the subjects, their potentials and limitations in educational spaces becomes important for us to know the advances achieved, setbacks in the teaching and learning relations, as well as in the relations between knowledge. In addition, to think about the potential steps from the constant progress of artificial intelligence (AI) in daily life and school routines and its influences for teachers and students in the learning and assessment processes. (PARREIRA; LEHMANN; OLIVEIRA, 2021)

CYBERCULTURE AND CYBERSPACE: BETWEEN RELATIONS AND TENSIONS

The popularization of information and communication technologies throughout the twenty-first century has reconfigured the dynamics of work and daily interactions. The space for interaction between individuals and institutions has expanded to virtual environments, where the internet enables more dynamic and simultaneous connections, involving an increasing number of people.

In this scenario, concepts such as cyberculture and cyberspace gain prominence in academic discussions, being explored by areas such as anthropology, philosophy, and sociology. According to Rüdiger (2013, p. 7), cyberculture represents a historical formation

of a practical and everyday nature, becoming a milestone for the societies that make use of it. Cyberspace, on the other hand, is understood as an effect of cyberculture, the result of cybernetic thinking. With the democratization of internet access and the creation of its own digital universe, cyberspace is consolidated as an essential platform for daily communication.

This development has been driven by massive investments by large corporations, technological advances in devices with greater storage capacity and connectivity, as well as the popularization of social networks and more accessible digital services.

Ferraz (2000) highlights the accelerated technical-scientific advance after World War II (1939-1945) and in the final decades of the twentieth century, influenced by the technological race of the Cold War (1945-1991). This progress requires a philosophical reflection on its impacts. Inspired by the Portuguese sociologist Hermínio Martins, Ferraz investigates the philosophy of technique underlying contemporary technoscience, seeking to understand the transformations in post-industrial societies.

Returning to the prosthetic theory of technology conceived by Ernst Kapp (1808–1876), Ferraz proposes that technical artifacts — and, by extension, digital artifacts — function as extensions of human beings, expanding their capabilities. Technologies emerge to meet human desires and needs, modifying habits, customs and even nature itself in search of greater comfort and efficiency. Whether in the development of telematic networks, more powerful machines or devices that shorten distances in communication and transport, technological advances have been decisive in social life.

Reflecting on the unfolding of cyberculture and its influence on institutional and behavioral dynamics is fundamental to understanding how this space modifies social and labor relations. Felinto (2004) addresses the digitalization of the body and subjectivity in cyberspace, criticizing the excessive idealization of this environment. According to the author, physical sensations — such as fatigue, excitement, heat or cold — are suppressed, giving way to a projection of perfection.

Cyberspace is often seen as a new paradise, where conflicts of gender, race, class, and religion are supposed to disappear. However, Felinto questions this utopian vision, highlighting the paradoxes between the real and the immaterial. By recovering the technological gnosticism of Hermínio Martins — who sees technology as a means of human transcendence — and Donna Haraway's Cyborg Manifesto (1985), the debate turns to the intentionalities behind technological use:

- What are the purposes of cyberspace?

- How do digital technologies and their artifacts shape institutional and human routines?
- What do we expect from them? Are they solutions or solutions?
- Who do digital technologies serve?

The issues listed are important markers for us to think about the ways in which digital technologies and artifacts directly interfere in people's personal and professional lives, to understand the possibilities and limitations of their use, as well as to try to understand these worlds. Real, fake, material, immaterial, from dreams or nightmares, perceptions are changeable and directly related to manipulations and intentionalities.

CYBERSPACE, DIGITAL ARTIFACTS AND PEOPLE (PHYSICAL AND AVATARS): THE *MODUS OPERANDI* IN EDUCATION

The popularization of digital technologies in everyday life, driven by the diversity of devices with high processing capacity and the increase in internet access, has transformed habits and routines.

In the school environment, these technologies have gained space, facilitating quick access to information about daily activities, such as the performance of students and teachers, the functioning of the institution, and communication with the community. Pedagogical practices have also evolved, whether by demand from schools, by the voluntary adoption of digital resources or by the transformation of the classroom into a virtual space.

Undoubtedly, the peak of the COVID-19 pandemic represented a moment of disruption, especially in education. Abruptly, it was necessary to adopt remote teaching during social isolation and, later, hybrid and face-to-face models, according to the gradual return to activities between 2020 and 2021.

These changes, imposed by the need to adapt to new ways of living and learning, drastically altered the organization, planning and mediation of teaching. Digital tools have become essential for maintaining relationships between students, teachers, and institutions. However, this implementation has occurred in an uneven and precarious way, especially for the most economically vulnerable populations, deepening disparities in access to education.

The forced modernization and hybridization of school environments during the pandemic had significant impacts on teacher-student relationships. On the one hand, they brought advances, such as the expansion of contact through digital platforms and the

incorporation of technological resources in learning. On the other hand, they revealed critical challenges, especially in accessibility.

According to Soares (2022), the mediation of teaching by TDICs (Digital Information and Communication Technologies) has come up against practical limitations: lack of adequate devices for teachers and students, obsolete equipment, difficulty in mastering the tools, unstable or non-existent connection and, in some cases, disengagement with the proposed formats.

In addition, the market biases in the use of these technologies, the significant increase in the value of digital artifacts, the low effectiveness and participation of students culminated in the creation of "digital peripheries". The term, coined by the author to exemplify the problems in maintaining approaches without adequate mediation, reinforced the exclusionary character of the proposal. Especially, for those economically and socially vulnerable population strata.

Thus, both students and teachers, unprepared for the intensive use of digital technologies for pedagogical purposes, without protocols or guidelines for adequate handling, or built in an improvised way to meet emerging demands, had precarious access to the potentials offered by digital platforms and their communication channels.

Finally, the activities made and developed were generally of little use in the sedimentation of knowledge, becoming tasks with the aim of generating contact between the school and the students and a way to maintain some connectivity or bond, something important for pedagogical relations. However, under the learnings, the information was fragmented and the processes were partially developed. In this way, it happened that "information appears indiscriminately, directed to no one in particular, in enormous volume and at high speeds, and disconnected from theory, meaning or purpose." (POSTMAN, 1994, p. 78)

After the pandemic periods and the resocialization processes, the teaching and learning processes have changed in their relationships, and there is a need to integrate, in many societies, digital artifacts and cyberspace in the dynamics and pedagogical routines.

The mismatches in the approaches and appropriation of technologies in school spaces was a dilemma faced by many educators, as relationships and interactivity challenged other forms of reading and learning, something to be thought about and integrated. With the advent of the use of Artificial Intelligence (AI) for pedagogical purposes

and in human daily lives, the importance of mediating knowledge and building it in a critical and humanized way has challenged school institutions and their processes.

For Tavares, Meira, and Amaral (2020), the use of AI is controversial, since it tends to replace human tasks or mechanize the ways of constructing learning. However, the authors affirm the potentials in its use as a support for learning tasks and resource optimization. Namely, in adaptive learning activities, guided tutoring, data diagnosis tool and data mining.

The use of digital technologies and digital artifacts (computers, *tablets*, *smartphones*, *video games*, among others), as well as their appropriation in educational situations are frequently debated subjects. For Kenski (2007), the inclusion of new technologies is capable of presenting different perspectives of learning and teaching from digital media.

As a result, new skills are demanded by teachers and students to carry out these processes. The author lists some in her work, from which we have selected the following from which we directly relate to the handling of technologies, artifacts and the use of cyberspace today, expanding its possibilities, resources and pointing out limitations:

Search: Search for some data and information in cyberspace through browsers or with the use of AI connected to the internet, which will search for the item from voice commands, described in a pictographed way or typed manually using major search engines to refine the information. This ability is used to search for general and specific information, to know what is happening in the world, to access interactive channels (*streaming), newspapers*, magazines, books or to search in digital repositories of some own intellectual production or that of other authors.

The quantity of data, resources and information impresses with the quantity and quality to users, as it is possible to adapt searches and refinements based on the keywords entered, thus personalizing the experience. However, the large amount of information is not directly linked to quality, as the access channels for the insertion of content are vast and, sometimes, not criterized, something harmful when considering the possibility of access to inappropriate content. Among them, violence, racism, criminals or with dubious sources and content.

The use of the cognitive capacity to select and refine searches according to the areas of interest, synthesis, interpretation of information and checking in reliable channels and comparison in various sources is a premise to be worked on in class and in school dynamics.

Cyberspace can be a great labyrinth if not sedimented and based on its access, time of use and limitation of information to be accessed in *links*, *hyperlinks* or pages. A danger to

be observed is the disambiguation of information and its fragmentation in repositories, audiovisual channels and pages

Castells (2004) emphasizes the development of intellectual capacity to handle cyberspace, reinforcing the importance of combining digitally stored information, recombining it and using it for the construction of new knowledge. In pedagogical mediation, guiding navigation is important in guiding the proper accesses, selection of content in various formats, teaching refinement of information, storage for later access and interpretation of the information collected.

Handling/Operability: Technological advances have allowed digital artifacts to extend their functionality and capabilities to users. The capabilities of processing data, information, performing simultaneous tasks and storage impress with their practicality, convenience and customization according to the preferences or needs that people have. The expansion of personalized products has expanded the range of consumers and, in the same proportion, the need to have advanced devices to keep up with the most up-to-date models.

With regard to teaching and learning situations, progress enables access to various types of content, information and the ability to perform tasks on devices other than computers. Among them, *smartphones,* devices with lower costs, *tablets* and *notebooks.* Advances in software have allowed content and activities to be expanded to simple access and navigability, varying activities for the customization of texts, productions of images, sounds, videos and other resources. In addition, the classroom space itself or dynamizations can be changed or accessed.

Classes and dynamics, depending on the teaching modality and pedagogical proposal, can take place in virtual learning environments (VLE), synchronously, that is, in real time, asynchronously (through activities or tasks deposited in virtual repositories), with access via a device with internet connectivity and compatible data processing capacity.

Among the most well-known environments today due to its layout and simple handling capacity, we highlight the *Modular Object-Oriented Dynamic Learning Environment* (MOODLE), which has its advantages and limitations. According to Soares (2022), among their strengths, online platforms provide resources in different formats, something interesting to their users because they allow the insertion of content in various models. Therefore, expanding the sensory capacity and access to information, contained in materials in text, video and audio formats, redirection resources to external sites, interaction with mediators, dynamization of contact via forums or *chat* with students or teachers/tutors.

The growth of virtual learning environments has enabled the growth of distance learning (DE) activities in short, medium and long-term free and professional courses; teaching in basic education in the high school modality for people over 18 years of age; undergraduate and *lato sensu specialization.* In addition, hybrid learning models, namely, semi-presential.

This popularization must be viewed with care and criticality, as many education models, especially in the blended or distance learning modality, are characterized by models of low operating cost, reflecting precarious training for students and also in working conditions.

Regarding digital artifacts, it is important to highlight some problems, from the constant monitoring of the innovations launched for the handling and operability of resources, the knowledge of the main educational platforms and repositories in order to avoid knowledge gaps.

In addition, constant updating of artifacts with compatible technologies to make the programs work (avoiding planned obsolescence), knowledge of *software* to optimize daily tasks or avoid "virtual cheating", processes in which chatbots, AI or the use of automated search for answers in school activities are improperly used.

Another point of attention is the loss of certain skills necessary for learning, such as reading physical books, which have different layout and formats from virtual ones, excessive reading on websites and consulting a single information channel, loss of motor skills in cursive writing, excessive dependence on screens and digital devices for the production or development of activities.

Production and customization: Culture *Maker*, that is, to carry out activities based on pedagogical mediation processes with greater student protagonism is one of the premises enhanced with the expansion of digital technologies. Based on productivity in virtual channels and with independent production media, it is a potential to be used from guided pedagogical mediations allocated in virtual spaces in official institutional channels.

The capacity for information processing, repositories with greater storage of data and media, customization and expansion allowed the productions carried out for pedagogical purposes to be accessed, organized and produced for observation, encouragement of new forms of knowledge production and characterization.

In particular, productions that involve interactive channels on social networks or with the potential to be published on them, to disseminate personal or group materials, have gained space with the ability of artifacts to symbolize attractive sound, aesthetic and imagery effects. However, the constructions of scenarios, dynamics and recorded activities

need to have filters and well-defined niches of proposals. In this way, the use of digital resources needs to serve to enhance knowledge and philosophical productions that are forceful to one or more curricular contents, pedagogical proposals, manifesting and stimulating student actions.

Considering the other environments, the customization resources from improvements in the quality of cameras, sound recorders, cameras, light effects, insertion of multiscreens and others provided amplitude in the teaching productions to the students. In particular, in the making of video classes, small didactic videos shared in pedagogical activities, insertion of sign language in audiovisual productions, among others. Also noteworthy are the media productions based on those carried out with the mediation of the professors, in which the students carry out the instruction, orientation of contents, research and dissemination of various works and researches.

The appropriation of digital technologies by teachers is a fundamental step towards the adequacy, observation of activities, mediation and demonstration of work possibilities to students, thus making points and counterpoints capable of guiding activities. In addition, it creates closer ties by appropriating technologies and tools, sometimes from the student's daily life, understanding their singularities, potentials and risks.

Undeniably, potentials are fruitful for the exploration of activities and resources of production and customization in pedagogical activities, but misrepresentations, amounts of edits about a given fact, action, speech of a person or excessive exposure should also be considered.

Currently, the scenarios of productions that are too fanciful, manipulated with a political bias, of ridicule of a person or social group or customized for the practice of digital *bullying*, known as *cyberbullying,* are frequent and deserve attention.

Therefore, the use of materials aimed at the production of student content is important to guide self-knowledge with methodologies aimed at self-directed connectivity, in which there are processes of individualized or group activities mediated by a teacher. With this, enhancing skills and resolving gaps, providing self-assessment processes.

However, there are still some problems in the actions for the effective use of these methodologies in greater depth in certain institutions. Access to digital resources is not usually equal in everyday school life, something that hinders deepening. The infrastructure of most Brazilian schools in terms of information technology is outdated or scrapped, which can generate fragmented learning or reduced processes in teacher-student production, something that can generate frustrations.

Accessibility: The expansion of the resources implemented in equipment and digital artifacts has made it possible for more people to be able to handle them and with greater assertiveness for educational purposes. In particular, the expansion of the resources of mobile devices, namely *notebooks*, *smartphones* and *tablets*, together with the popularization of broadband in many territories (even so insufficient if the national conjecture is conceived), facilitated many accesses and the application of differentiated methodologies in educational practices.

Considering the artifacts, access to customized programs for the teaching of certain curricular content, interactive whiteboards, use of digital games, digital assistive technology equipment are some expanded resources in pedagogical mediation or in the dynamization of tasks.

In the activities, it is important to use technologies in a dialogical and optimized way, valuing human relationships, their subjectivities and potentialities. Otherwise, they will be underused or may even discourage the appropriation of these technologies to users.

The ability to connect subjects impresses with the infinite possibilities contained. Imagining that contacts can occur simultaneously, between subjects from the most varied physical spaces on the planet, in situations of joint work on digital platforms or in real-time projects reconfigures relationships.

Working with digital technological tools, together with others, bringing together subjects with ethics and commitment to progress and constant symbolic exchanges with a view to learning is a complex task, which demands technical and human skills in the processes.

SOCIAL-COGNITIVE SKILLS IN DIGITAL OPERATIONS

The influence of the internet and cyberspace on human life has expanded the forms of relationship between subjects in a unique way, resignifying activities and their purposes. Monereo (2005) believes that the internet has transformed socialization relationships and communication models. The author identifies four socio-cognitive competencies in the handling of the internet, which we will seek to expand and contextualize with the current scenarios.

Learning to search for information: In the twenty-first century, cyberspace has become a large territory in which the offer of products, goods and services have been expanded.

Likewise, the amount of information offered is practically immeasurable. However, it does not mean that they are synonymous with quality, nor that they are effectively accessed properly. Teaching how to search for data and information is an important task in digital literacy processes and communal use, as the disambiguation capacity of search engines is relevant and can lead to searches with few refinements or inaccurate results.

Therefore, knowing which keywords to use, the ways of arranging the information (word order), correct spellings, language, closed expressions to refine searches (words in quotation marks), observing the use of reliable sources and official communication channels are increasingly necessary skills. Thus, optimizing results, learning to use cyberspace consciously and critically, and accessing relevant quality information.

Learn to communicate: Communication has been a skill required for human existence since time immemorial.

Analyzing and understanding the ways to reach the public, to expose information, to receive it and to share it according to ethical elements and rules of the virtual communities in which relationships are built are necessary for the conscious use of cyberspace.

Regarding pedagogical activities, productions can value multiple communication channels (visual, audiovisual, phonographic, *podcasts,* among others*)* to reach varied audiences, encourage productions with multiple resources and sources (short films, use of simple, complex, cinematographic, comic book graphic elements, *manga* and avatars).

Knowing the characteristics of the public served, having good planning of scripts and disposition of information are characteristics to foster pedagogical activities of good communication and understanding to users.

Learning to collaborate: Collaboration in teaching and learning processes are basic skills, but they require varied skills from subjects in order to achieve success.

Collaborating from cyberspace and in educational relations provide unique knowledge and consolidation of relationships that permeate the subjects in the symbolic field, of sharing knowledge and work respecting the powers of the group.

This competence is beyond a button on which we can share information, *link*, data or image. It means having the ability to read the world to select relevant information, of importance to a group or subject, to interrelate in community and to dialogue with the world about one or more themes. In everyday school relationships, it means democratizing knowledge, allowing the exchange of knowledge and being ready to perform tasks, solving problems, proposing situations and learning to learn constantly.

Learning to participate in society: Understanding that we live in society is not a simple task. It requires the ability to observe and integrate with various groups in order to build collective knowledge, to integrate areas of knowledge in a given activity or to get to know other worlds.

Participating in society demands observation beyond the initial perspectives, seeking forms and contacts with other groups, understanding possibilities and limitations in contacts, being open to changes and new ways of doing or building knowledge. In the dynamics of educational relationships, it means sharing findings inside and outside the classroom to the world, perceiving and interacting in order to build legacies and time frames.

Digital technologies and cyberspace are tools capable of performing fantastic actions in human daily life, integrating people in the same environment, overcoming spatial-temporal barriers and communication difficulties. However, we must be attentive to their exaggerated handling, the coldness of relationships and procedures, or the belief in democratic and equal access to digital technologies, their artifacts, and accessibility to the internet.

Wives (2013) points out that some countries, such as China and other regions of the planet, provide contacts that are strongly mediated and censored by the government, which jeopardizes the full use of informational resources, forms of communication and accessibility to specific content. Namely, contrary to the political and philosophical currents of a government, the limitation and acquisition of goods, products and services, among others.

Thus, the wonders of a digital utopia of accessibility still contrast with a neotechnicism (FREITAS, 2011), being processed by factual knowledge to be reproduced. Namely, the increase in advertisements or content intentionally carried out by *prompts* to induce the commercialization of products, massification of certain information or news.

In the educational area, the behavior is not different. In fact, it is harmful when observing the mass use of digital artifacts as an instrument of mechanization of teaching practices, reproduction of school content without theoretical depth and spectacularization of curricular content without adequate methodologies.

The school, as a social institution of great relevance to society, plays a fundamental role in the appropriation and conscious use of digital technologies. The exercise of citizenship, acquisition of new skills from cyberspace, promotion of the construction of knowledge from new technologies and values coincide with Kenski's (2007) proposals, in which the school space, whether physical or digital, is transformed into a place for the exploration of culture, design and realization of projects, research and debate.

A "HYBRID" SOCIETY? THE RELATIONSHIPS BETWEEN TECHNOLOGIES, SCIENCE AND PEOPLE.

The insertion of digital technologies in human life is analyzed by several philosophical currents that seek to go beyond their functionalities, exploring their social and cultural impacts. According to Castells (1999), large-scale communication processes have undergone profound technological and organizational transformations, characterized as mass communication based on horizontal, multidirectional and interactive networks. These channels, which used to manifest themselves physically in spaces such as squares, unions, associations, and schools, today also materialize on the internet, reconfiguring the dynamics of social interaction.

In this digital environment, communication takes place in interconnected networks of multiple cores, aligning with the concept of the "global village" proposed by McLuhan (1962), who highlighted the increasing dependence on communication channels in a process that would later be known as globalization. While the metaphor of global villages is questionable, the idea of close social groups (or "tribes") remains relevant to understanding the relationships built in digital environments, where virtual proximity redefines social bonds.

Other fundamental concepts today are *Big Data* and *Data Mining*. Nazaré (2019) defines *Big Data* as a set of data marked by the "three Vs": volume, velocity, and variety. Data *Mining, on the other hand*, is more complex in its definition, and refers to the "process of processing data and extracting information and knowledge". These two elements, driven by scientific and technological advancement, facilitate interaction between individuals, organizations, and society, allowing the collection, exchange, sale, and processing of data to predict behavioral patterns.

From a market perspective, this data generates social and economic value, being used for the sale of products and services, locating people, and tracking consumption profiles. At the institutional level, such as in schools, they allow analysis of performance, attendance, grades, and disciplinary records, offering insights into students and classes. However, Nazaré (2019) warns of the risks involved in the storage and use of this information. While anonymized data is used for censuses and social indicators, cases such as the Snowden leak (2013) have exposed ethical flaws in mass surveillance systems, raising questions about privacy and consent.

Unstructured data poses even greater risks, as it is often collected without proper control or explicit consent. This raises ethical dilemmas such as the violation of privacy, the unauthorized use of information, the lack of transparency in the processing of data, and the dangers of constant surveillance. These challenges highlight the need for stricter regulations and critical reflection on the role of digital technologies in everyday life and work, balancing innovation with fundamental rights.

Regarding the appropriation of digital technologies and their applicability for pedagogical purposes, the mediations need to occur so that students can visualize the use of artifacts, have contact and appropriate the handling of technologies in pedagogical routines. However, one cannot lose the skills to investigate and explore other media in the processes.

Productions need to go beyond simple storage and access from digital clouds (content repositories in virtual spaces). They need to be touched, perceived and felt with the body, as there is a risk of losing the materiality of objects, ways of reading the physical world and the loss of sensations and humanized touches in the processes.

Currently, there are demands from subjects to access products, services and goods through cyberspace. However, it does not mean that we are necessarily human avatars inserted in virtual spaces (or would it be the other way around?). The issues that delimit the beneficial and harmful uses of digital technologies in human tasks are progressing, referring to experiences that challenge us daily.

SCIENCE, TECHNOLOGY AND EDUCATION: BETWEEN FAUSTICS AND PROMETHEANS.

For Jorge (2019), technology requires knowledge that can apply and respect the rigor of the scientific method, but its use involves factors that go beyond this method, such as social, economic, political, and cultural issues. The author highlights that technology has a positive effect on the scientific representation of the world, moving away from science's

initial search for truth to focus on the new, the improved and the effective, aiming to transform reality and expand human control over their lives.

Jorge (2019) also provokes reflections by associating technology and science, recalling that, although the former is linked to innovation and progress, it cannot be assumed that it is neutral or free of ideological intentionalities.

Pedrosa, Costa, and Mamede-Neves (2021) associate the use of technologies with those of humanity in their appropriations and use in everyday life, which are conceived from their functions and perspectives. Based on Martins (1977), they mention two paths in the use of technologies. One of them, the Faustics, a metaphor to evoke the mythological figure of Faust, with a passion for novelties and progress, having made a pact with the devil to achieve success, having later repented and the Prometheans, an allusion to the titan punished for having stolen fire and shared it with humanity.

Rudiger (2013) understands that in the educational field there are these two hegemonic currents, but points out ways for a third, which defend thoughtful positions on digital technologies.

Selwyn (2008), when studying English educational systems, observed that the lack of access and basic skills to use technologies such as computers were major obstacles, evidencing the impact of digital inequality. He argues that initiatives with ICT (Information and Communication Technologies) should abandon idealized visions and rethink their role in social inclusion, since the use of technology does not always empower – sometimes fragments and marginalizes.

Jorge (2019) contrasts science, seen as reflective and "disinterested", with technology, which is more interventionist. The approximation between both fields occurs in epistemological aspects and in the absorption of technological tools by scientific research. However, there is a risk in associating science directly with technology, as if progress depended exclusively on digital devices, from simple to complex tasks.

The development of AI and its applicability in educational situations should be discussed and debated in everyday life and school routines. We believe that the tool, accessible free of charge, can offer gains in teaching and learning relationships, as long as they are mediated and taught in their operationalities. However, we cannot deny the damage caused when mismanaged. In particular, to replace activities of an essentially human nature such as textual productions, the operation of calculations without philosophical appreciation, the making of graphic arts without care for copyright and other issues that emerged according to the advances of the tools.

Selwyn (2016), based on Postman (1997), warns that technologies are not neutral: they carry values and interests, shaping visions of society. In education, they are often implemented under a market logic ("mastering technology so as not to become obsolete"), which can reverse the relationship – it is technology that comes to dominate the individual.

Selwyn rejects technological "solutionism" (MOROZOV, 2013), which sees digital artifacts and their massive use as magical answers to educational problems, ignoring real contexts of schools, teachers and students. The author (2016, p.93) vehemently states that "digital technologies in education are not neutral, but rather vehicles of assumptions and ideas about the future of society".

However, although networked digital technologies have the power to promote social interaction, they are sometimes seen as media that take on characteristics of mass communication, with unidirectional perspectives. In this way, approaching technicist biases. Pimentel and Carvalho (2020) denounce post-massive perspectives to promote interactivity, a technological determinism appropriate to put into effect different didactic-pedagogical approaches.

In relation to the educational methodologies adopted at the beginning of the twenty-first century, such as Technology-Enhanced Learning, or even the approaches of the 1980s and 1990s, such as Computer-Supported Learning, Selwyn (2016, p. 92) draws attention to the idea of "mastering technology". However, in the face of market discourses and the pressure for technological insertion in educational practices, a contradiction arises: instead of teachers and students controlling digital tools, they are often dominated by them — whether in their routines or in their worldviews. The demand for "technological mastery" to avoid obsolescence, treating humans as machines in constant updating, reveals a worrying inversion: it is technology that starts to dictate the rules.

The belief that technological innovations would solve educational challenges, however, often exacerbated inequalities. The mere availability of digital resources does not guarantee improvement in teaching, especially when it is disconnected from a consistent pedagogical project, student engagement, the adequate infrastructure of institutions, or the real demands of the school system. In this scenario, commercial and ideological interests often override social needs, turning technology into an end rather than a means.

Selwyn (2008, p. 817) warns that, although globalization can empower certain groups, it also intensifies "fragmentation, marginalization and loss of power". This reflection raises questions about the supposed democratization promoted by technologies: to what extent does access to devices and networks really imply inclusion? Is hyperconnectivity synonymous with equity — or an illusion that masks new forms of exclusion? In addition, we

raise the question of the extent to which current technologies are configured in power structures in the alienation of subjects and in their socioeconomic-cultural exclusion?

These dynamics refer to the power relations analyzed by Karl Marx and taken up by Selwyn (2016), in which technological inequality reinforces class divisions. On one side, there are those with access to high-speed networks, advanced devices, and privileged information; on the other, a portion that is "disconnected" or with limited access, whether due to financial, geographic or social restrictions. Technology, far from being an equalizer, can thus deepen chasms.

In addition, digital tools themselves can be instrumentalized to consolidate hierarchies: platforms legitimize certain ideologies over others, algorithms reproduce stigmas, and disinformation amplifies the isolation of vulnerable groups. One of the most critical effects of this configuration is the marginalization of those who do not fit the connectivity standard — either due to lack of infrastructure or resistance to the indiscriminate adoption of novelties. Added to this are the monopoly of large technology corporations and the growing dependence on digital systems even for daily activities, reducing individual and collective autonomy.

In summary, the debate on technology in education cannot be restricted to naïve optimism. Nor to the complete exclusion of new technologies. It is necessary to question who controls these tools, who is controlled by them, and how to transform them into instruments of emancipation – and not of domination.

In the same proportion, to highlight the main uses for educational scenarios and their applicability according to the possibilities in learning situations.

FINAL CONSIDERATIONS

The advancement of digital technologies and available resources undoubtedly influences the professional and daily lives of millions of people. However, focusing exclusively on these innovations, neglecting other factors, can be a dangerous and ineffective way to understand the true dimension of the transformations resulting from this progress.

The promises associated with the use of technology are numerous: from personal development and the cure of diseases to the creation of a more democratic and inclusive space. By exploring cyberspace and its benefits, concepts such as "*web*" (network), "connectivity" and the storage of data in the "cloud" have become part of the daily lives of internet users. These innovations have facilitated communication, brought people together,

and optimized the performance of various activities, thanks to telematic networks and available digital resources.

The popularization of these technologies has brought significant advances in several areas, such as scientific research, more precise medical procedures, data storage, content dissemination, and the creation of transmedia channels. However, initial expectations that technology would solve all problems have been revised as society has evolved. Old questions persisted, and new dilemmas emerged, demonstrating that digital progress is not an infallible solution.

Whether for or against the use of digital technologies, it is essential to adopt a critical stance towards their application, both by institutions and individuals. This reflection is fundamental to understand the implications, possibilities, challenges, and limits between what belongs to the virtual world and what is inherently human.

After all, are we *on* or *offline*? Are we real, immaterial or "hybrid" beings?

REFERENCES

1. Castells, M. (2004). A galáxia da internet: Reflexões sobre a internet, negócios e a sociedade. Zahar.

2. Castells, M., & Espanha, R. (1999). A era da informação: Economia, sociedade e cultura. Paz e Terra.

3. Felinto, E. (2004). O corpo impuro: Sobre a digitalização da matéria no imaginário da cibercultura. In CD-ROM da COMPÓS. Universidade Metodista, São Bernardo do Campo.

4. Ferraz, M. C. F. (2000). Sociedade tecnológica: De Prometeu a Fausto. Revista Contracampo, (4).

5. Jorge, M. M. A. (2019). Relações entre ciência e tecnologia. In Ética aplicada: Novas tecnologias (pp. 103–124). Fundação Luso-americana para o Desenvolvimento, Editora 70-Grupo Amedina.

6. Kenski, V. M. (2007). Educação e tecnologias: O novo ritmo da informação. Papirus.

7. Lemos, A. (2007). Ciberespaço e tecnologias móveis: Processos de territorialização e desterritorialização na cibercultura. In Imagem, visibilidade e cultura midiática: Livro da XV COMPÓS (pp. 277–293). Sulina.

8. McLuhan, M. (1962). The Gutenberg galaxy: The making of typographic man. University of Toronto Press.

9. Monereo, C. (2005). Internet, un espacio idóneo para desarrollar las competencias básicas. In Internet y competencias básicas: Aprender a colaborar, a comunicarse, a aprender (pp. 5–26).

10. Nazaré, M. H. (2019). Big Data e desafios éticos. In Ética aplicada: Novas tecnologias (pp. 315–332). Fundação Luso-americana para o Desenvolvimento, Editora 70-Grupo Amedina.

11. Parreira, A., Lehmann, L., & Oliveira, M. (2021). O desafio das tecnologias de inteligência artificial na educação: Percepção e avaliação dos professores. Ensaio: Avaliação e Políticas Públicas em Educação, 29, 975–999.

12. Pedrosa, S. M. P. de A., Costa, A. V. de F. da, & Mamede-Neves, M. A. C. (2021). Entre fáusticos e prometeicos: A busca de uma terceira via para a utilização das tecnologias na educação. Revista UFG, 21(27). https://doi.org/10.5216/revufg.v21.69966

13. Pimentel, M., & Carvalho, F. da S. P. de. (2020). Aprendizagem em rede. Horizontes – Sociedade Brasileira de Computação (SBC). https://horizontes.sbc.org.br/index.php/2020/06/aprendizagem-em-rede/

14. Postman, N. (1994). Tecnopólio: A rendição da cultura à tecnologia. Nobel.

15. Postman, N. (1997, March 11). The surrender of culture to technology [Paper presentation]. College of DuPage, Glen Ellyn, IL, United States. http://bit.ly/2nf0rIc

16. Rüdiger, F. (2013). As teorias da cibercultura: Perspectivas, questões e autores. Sulina.

17. Selwyn, N. (2008). O uso das TIC na educação e a promoção de inclusão social: Uma perspectiva crítica do Reino Unido. Educação & Sociedade, 29(104), 815–850. http://www.scielo.br/scielo.php?script=sci_arttext&pid=S010173302008000300009&lng=pt&nrm=iso

18. Selwyn, N. (2014). Educational technology as ideology (G. M. S. Ferreira, Trans.). In N. Selwyn, Distrusting educational technology. Routledge. https://ticpe.files.wordpress.com/2016/12/neil_selwyn_distrusting_cap2_trad_pt_final.pdf

19. Soares, K. P. (2022). História, educação e games: Literatura gamer em história no século XXI [Doctoral dissertation, Universidade Estácio de Sá]. Rio de Janeiro.

20. Tavares, L. A., Meira, M. C., & Amaral, S. F. do. (2020). Inteligência artificial na educação: Survey. Brazilian Journal of Development, 6(7), 48699–48714. https://doi.org/10.34117/bjdv6n7-496

21. Wives, W. W. (2013). Situações de conflito no uso da internet: Embates e soluções [Master's thesis, Universidade de Brasília]. Brasília.