

# The impact of technology on education

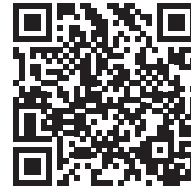
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## ABSTRACT

Technology has been impacting the entire society, not only by means of its benefits in comfort and increased productivity, but also, and mainly, by changing human relationships and the way power is exercised. We are in a time of transition where practices, concepts and values from past centuries coexist with behaviors, values and structures from the 21st century. This coexistence, not always peaceful, is the biggest challenge that political actors in society (including teachers and education operators) face in their daily lives.

**Keywords:** education; educational technology; social impact; transformation of society.

## INTRODUCTION

Many studies have already demonstrated the undeniable benefits that technological development has brought to modern society. We live longer and with better quality. We better feed a growing population. We face the health and environmental crises that we have been periodically experiencing, quickly and efficiently. We have more comfort and convenience at home and in the workplace (Hobsbawm, 1995).

Despite these benefits, technology has brought with it issues that are gradually being resolved by society, with the help of technology itself: pollution in general, climate change, depletion of natural resources, crowding in urban centers, etc.

In this study, we will show how this technology is mediating the educational process (formal and informal) and, mainly, power in its various manifestations. We will start with a quick overview of the evolution of technology and its impacts on society and people's daily lives.

Next, we will reflect on how this technology is mediating education and power. Naturally, as actors and, simultaneously, as spectators of modern reality, our reflections are based on personal experience and corroborated by several authors collected over the last few years.

The text is structured with a quick presentation of the evolution of technology, followed by a reflection on the values and behaviors of modern society. We proceed to the challenges of modern education, addressing the coexistence of obsolete educational structures with the new roles that have been informally assigned to school.

We conclude with reflections on the power mediated and affected by technology and how this same technology must be appropriated by education, both as a teaching tool and a subject of study to prepare young people for modern life.

## **BENEFITS OF MODERN TECHNOLOGIES**

Around 1971, the Club of Rome published a report called Limits to Growth (Meadows; Randers; Meadows, 2007), which advocated the depletion of natural resources in less than 100 years' time. One of the predictions was that we would not have enough arable land to feed the population in the following 100 years. With the announcement of this imminent catastrophe, society naturally reduced its growth rate, we opened new areas for agriculture, and scientific and technological research created more resistant seeds and more efficient agricultural processes. Therefore, we have been able to feed around 8 billion people.

Still under the effect of the Club of Rome report, which predicted the end of oil reserves, in 1973, OPEC (The Organization of the Petroleum Exporting Countries, created in 1960) raised the price of the barrel of oil in order to increase the duration of the reserves known and make the existing ones profitable. Such an attitude made exploration in areas previously neglected by oil companies economically viable (Oliveira; Brotherhood, 2022). Engines developed and became more efficient. New substances replaced part of the oil-based fuels (such as ethanol and biodiesel). We are in the heart of the 21st century and, every day, we discover new oil reserves in more remote and hardly accessible locations. All on account of technological advances in prospecting, materials and robotics, and automation.

In 1992, a new prediction astonished the world: climate change (Conferencia de las Naciones Unidas sobre Medio Ambiente y Desarrollo, 1992). Immediately, a number of actions was initiated in virtually all countries to reduce the impact of modern life on the atmosphere and the environment. With innovative technologies, we have eliminated CFCs from air conditioning units, we are gradually replacing fossil fuels with biofuels and using other energy sources, such as solar and wind. Hydrogen has come to the spotlight again as an important component in the energy mix, as well as new batteries and other ways of storing electric energy. We are still at risk, but the path to environmental recovery is already being followed.

New diseases emerge with some frequency and occasionally become pandemics. This happened with the Spanish flu, AIDS, Ebola, H1N1 flu and, more recently, Covid-19. With each epidemiological emergency, new medicines and treatments emerge, increasingly faster and with innovative technologies. The recent case of the Covid-19 pandemic is an example: in less than 1 year, we already had highly efficient vaccines and managed to fight a very aggressive disease with excellent results, when compared to the major epidemics of the past (World Bank Group, 2021; Hays, 2005).

Until the 1970s, an international telephone call was a feat due to its difficulty (it involved national and international telephone operators) and its high cost. The quality was poor and we only transmitted voice.

Person-to-person mobile communication and video conferencing were seen as science fiction, far into the future. Today we speak via cell phones anywhere in the world and at virtually zero cost (Mota et al., 2019). We send photos, videos, texts, music and films in seconds at the tip of our fingers. The world has become much smaller (Bellemey, 2000).

We can now “speak” in natural language with machines that follow our orders, with no complaints. We have appliances that work alone, cleaning the house, monitoring the environment, taking care of pets, preparing our food and even shopping for groceries, autonomously and independently. We already have humanized robots that are capable of being a pleasant company for lonely children and elderly people (Sichman, 2021).

The old routine of dressing appropriately, going to work, spending hours at the company and then returning home facing long and exhausting commutes is becoming increasingly rare, with teleworking (Figueiredo et al., 2021; Nogueira; Patini, 2012). Robots and smart machines are replacing humans in handling industrial equipment and inputs, just as additive and decentralized manufacturing is reducing the size and complexity of manufacturing industries (Barbosa, 2018). We are more productive and less stressed about work. We make better use of our human traits and leave manual, repetitive and low-complexity work to smart machines and systems (Evers, 2018).

Entertainment options were few in the mid-20th century. Basically we had books, movies, theater, bars, restaurants and few (natural or amusement) parks. All of these options, except books, required families to travel to specific locations designed specifically for these purposes. Today we watch movies and plays at home while enjoying food from our favorite restaurant comfortably in our sofa. We can visit distant museums on the internet and even have immersive experiences using virtual and magnified reality glasses. All from the comfort of our homes.

Despite the wars that we still have to endure and several issues inherent to the speed of change we are experiencing, we are indeed in a brave new world that we must better understand to make the most of it in a plentiful, healthy and safe manner.

## **VALUES AND BEHAVIORS OF NEW GENERATIONS**

Technological changes cause social changes, to a greater or lesser extent. In recent decades, we have witnessed important changes in social values and behaviors that are demanded by new generations and, at the same, time opposed by previous generations (Freitas; Segatto, 2014).

From the counterculture movement in the 1960s, the concepts of family and sexuality changed and were made more flexible (Brandão; Duarte, 1990; Groppo, 2000). The family where the father was the provider, the mother was responsible for taking care of the home and the upbringing of the children (who owed total obedience to their parents) was gradually transformed.

Mothers also started working to help support their families, leaving their children in the hands of the school and, occasionally, placed in the care of nannies and household servants, who are not always qualified for such duty.

Without the parents' presence, children spend most of their time in the company of servants who do not have the same socio-cultural reference as that of their families, nor are they responsible for the children's development, making their educational and social improvement difficult.

Because they are servants, they do not have the authority to enforce the orders required for the children's upbringing, making the latter disobedient and disrespectful towards them. As a result, they grow up without the reference of authority that their parents, if more present in the family's daily life, would be for them. The lack of a reference of authority translates into rebelliousness at school and against teachers, and into disobedience to tacit codes of social conduct.

The result is a youth that leads to accelerated changes in social practices (Silva; Pereira; Braga, 2011). The large political and regulatory space already conquered by active and empowered youth has deprived them of the motivation to fight for their independence, and it is common for these now grown adults to remain at the expense of their parents, as if this were the parents' obligation. The lack of motivation for individual socioeconomic growth also leads to school and job abandonment, creating a number of young people who are out of school and out of the world of work (called the neither-nor generation - neither do they study, nor work).

## **THE NEW CHALLENGES OF EDUCATION**

Modern education needs a major revolution to adapt to the new demands of the world of work and new social values and behaviors (Arendt, 2005). The main changes are:

- greater alignment with the world of work, both in theoretical content and, mainly, in work practices
- greater focus on developing attitudes and less on knowledge acquisition
- encouraging group work, problem solving and entrepreneurship
- development of ethical behavior and respect for differences
- socio-environmental engagement

It has been a long time since the world of work has been complaining about the gap between educational training and the needs of companies. This gap is more evident due to the limited availability of technical courses, combined with the low recognition and appreciation of these professions. This gap is greater in technological areas, where companies, when choosing applicants, are already disregarding diplomas in favor of experience.

Our higher education was designed to train scientists and, in this regard, we are very efficient. On the other hand, the effort for specific training aimed at preparing young people for work in companies was reduced to short periods of supervised internship. Mandatory internships were reduced to activities without motivation for students, or, at most, as a way to generate income while studying (Pasqualetto; Fonseca, 2016).

## **EDUCATIONAL STRUCTURES OF THE 20TH CENTURY WITH STUDENTS OF THE 21ST CENTURY**

In most schools, whether public or private, we find an educational architecture and pedagogical practices that have persisted for more than two centuries. The teacher as the holder of knowledge placed in front of a class of young people considered ignorant on the subject, who must listen with interest to hours of lectures coming from the authority in the room, the teacher. This educational structure was efficient in a reality where:

- the majority of young people attending schools came from families concerned about their children's future.
- the sources of knowledge were the few books and the teacher, who had the role of transmitting and facilitating the knowledge acquisition process.
- options for social growth were few and virtually all depended on educational training. There were no significant alternatives for social growth outside of traditional companies.
- parents were more involved in their children's school life, thus ensuring that family values and appropriate social attitudes within the school were developed in young people.

Reality today is very different, that is:

- the increased number of slots available took a huge number of young people to school, without there being a process of motivation and engagement with them with a view to a better future.
- school is seen by a significant part of families as just a place to leave their children and where they could eat a snack;
- the internet is a source of knowledge that is more agile and easier to access than school. The diversity of media, languages and formats for the same topic streamlines the acquisition of knowledge, which is always available when needed;
- there are several alternatives for social growth where educational training is not so relevant (for singers, actors, sportsmen, artists, bloggers, etc.) which makes school even less interesting for young people;

- because they are at work, parents leave their children in the care of household servants and other people who are not responsible for the formation of young people's values and behavior. On the other hand, parents do not grant these caregivers the required authority to impose appropriate values and behaviors. As a result, they grow up without values such as respect for authority, respect for differences and those who are different, care in interpersonal communication and other values required for a harmonious social coexistence.

Thus, we have a potential arena of conflict between the traditional educational structure and new profiles of young people with values and expectations that are different from those expected by the school. This dichotomy between the school structure and the behavioral profile of students is one of the causes of school dropout and conflict (even reaching physical violence) among education actors (Trezzi, 2021).

The modern school, to meet the new profiles of its students, must:

- be flexible in terms of hours. People have different biological clocks with peak attention spans at different times;
- be flexible in terms of content: Young people have different interests, which should be taken advantage of by the school to offer them content aligned with their vocations.
- be flexible in terms of didactics: Mandatory basic subjects must be offered in different formats and media so that students can find the one they understand best.
- be focused on developing skills and attitudes: The world of work requires competence and behaviors that schools today fail to develop. Non-technical skills (soft skills) are the main requirements of companies when hiring professionals and such skills are not developed in traditional schools.

As we can see, the school that can meet the demands of modern society today is not the traditional school. To adapt, the school will need investments in processes, technology, new curricula and active methodologies.

The only viable way for the school to serve the large volume of students, with low operating costs and still train professionals prepared for the world of work, is through the adoption of modern methodologies and educational technology (Garofaro, 2022).

Distance Learning, Remote Learning and In-person Teaching should not be treated as course formats, but rather as teaching strategies to address each subject. For example, some Physics content can be taught via an asynchronous distance learning platform, others can be taught remotely with an online teacher and some must necessarily be taught in person. All the same subject.



Active Methodologies are teaching strategies suited to the demands of the modern world as they place the development process in the hands of the students themselves. Projects, problems and concrete cases allow students to acquire knowledge and develop the desired skills while carrying out real practical activities. This not only motivates students, but also shows in practice the applicability of the knowledge covered in the subjects (Santos, 2015).

With active methodologies, the teacher becomes a mediator of the student's development process and no longer the holder of knowledge. This change in role requires, among other actions, change in the architecture of the classroom itself. The teacher should not stand in front of an ordered array of desks. Students must be organized into small groups, through shared work desks and the teacher will circulate between them, answering questions and encouraging students in the project in progress.

Another important action for the successful adoption of active methodologies is changing the teacher's profile. A project, or a problem, normally presents a multidisciplinary nature that the teacher must master. A drone project, for example, involves knowledge of aeronautics, fluid mechanics, calculations, mechanics, engines, servomechanisms, on-board electronics, programming, structures, materials and other support areas. The teacher must have basic knowledge on all subjects to be able to guide students on where they can obtain the necessary knowledge to complete the project (Lara et al., 2019).

Finally, another relevant action is the student's assessment, which should focus less on the amount of knowledge they are able to retain in memory and more on the competence in using their knowledge and skills to solve problems. The assessment must also measure the degree of development of behavioral skills, such as the ability to work in groups, organization of the work space, punctuality, quality of the work performed, degree of collaboration with the group and the class, leadership capacity, proactivity among other characteristics relevant to the world of work (Baldissera, 2019).

## **POWER MEDIATED BY TECHNOLOGY**

In the last few years, we have seen the great power of mobilization and engagement of social networks in favor of social movements of different themes and ideological nuances. Social networks are taking over the space that was once used by the press, radio and TV with the enormous advantage of speed and reach. News about a relevant fact reaches millions of people within minutes long before it appears in the traditional news (Timms; Heimans, 2018).

The speed of dissemination of facts (whether true or false) and the enormous amount of information and knowledge (also, true or false) available at the click of a button brings yet another demand to modern education: developing in young people the capacity for critical analysis in order to be able to separate good content from bad.

The ability to critically analyze content in general allows young people to choose subjects that can actually add knowledge, culture and develop attitudes consistent with life in society and the world of work. This ability is essential for self-study and reading news and messages distributed throughout social networks.

The media in general have always been instruments of engagement and opinion formation among the population. With the invention of the printing press by Gutenberg, leaflets and newspapers became popular and helped to involve a greater number of people in favor of causes led by those in power or by those who opposed it. The internet accelerated the dissemination and expanded the extent of information, reaching the entire planet in moments (Dias; Couto, 2011).

In the past, most information and content was generated by people with officially assigned roles and duties such as journalists, writers, teachers, etc. Today, anyone can publish a book without going through a review process (spelling, semantics or content), they can publish an article reporting, or analyzing, a fact with no concern about verifying the veracity of the facts narrated or the relevance of the conceptual basis adopted.

Even with the help of technological tools, it is possible to forge facts, speeches and videos, illegally using the image of public figures to give some reliability to a non-existent or modified fact. The results of these manipulations are so good that they can deceive anyone who does not have enough knowledge and discernment to clearly evaluate the matter to the point of classifying it as a fraud (Faustino, 2020).

With all this power of dissemination, of creating factoids and of modifying the context of the narrated facts, social networks have become a powerful instrument of power, taking over the space left by the traditional press. It has become easier to create social movements through the Internet mainly because, in addition to technology resources, we have little capacity for discernment by a significant part of the population.

The social movement called the Arab Spring, in the late 2010s, which began with the overthrow of the Turkish dictator, went through the deposition and death of the Libyan dictator and culminated in the deposition of the Egyptian dictator, was organized through social media and without there being a specific identified leadership.

The absence of leaders is the main trait of social movements mediated by technology (Gohn, 2011). Young people, mastering technology, both in its use as a means of communication, but mainly as a tool for generating content that engages other people, are able to create messages in favor of purposes that motivate their peers to engage in social struggles.



In all current movements there is no personified leadership, but only a well-defined and objective purpose. It is the purpose that brings people together, not the leader. This happened with the Black Lives Matter, Me Too, Passe Livre, Black Block, Brasil Livre Movement, Truck Drivers Strike and other movements. Even upon analyzing past facts, we cannot clearly identify a permanent leadership of these movements.

The success of these movements is due to three factors resulting directly from current education:

- Lack of sufficient critical analysis capacity to take a considered and conscious stance on news and information
- Inability to address complex themes and concepts, which leads to embracing simple and direct topics, even if there is a set of complex concepts, theses and developments in the background
- Inadequacy of the formation of traditional power structures in predicting and addressing these movements to limit their strength and harmful effects on holders of that same power.

## **FINAL CONSIDERATIONS**

As we have shown, Brazilian education is misaligned with modern social and business demands. We are prodigal in training scientists, but not in training critical citizens and productive and efficient professionals. This gap in our educational strategy has led (and continues to lead) to the formation of a huge number of people without critical analysis skills who are easily manipulated in favor of well-communicated topics that have some relevance, even if marginal.

We are not only referring to people with little academic training, but we include professionals with a university degree who also have not developed the appropriate skills to live in modern technological and media society. All educational levels must be adjusted to the current technological society, not only in the appropriation of technology for use in the educational process, but, mainly, to incorporate attitudinal practices that enable better use of technology in people's daily lives.

Our lives are increasingly dependent upon different technologies and we must adapt our social practices to them. From creating a technological etiquette to the ability to consciously and critically separate what is good from what can harm people and even society.

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