Teachers and Technologies in Brazilian Schools: a Study From the Perspective of Media Ecology

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Abstract: The theoretical perspective of media ecology, addressed by McLuhan (1962), Postman (1970) and Ong (1982), interprets media as immersive cultural environments, in which relational aspects gain relevance. Shifting focus from the effects of media to languages that comprise it, this approach seeks to understand the significant changes that technologies bring about in all human spheres. The objective of this article is to investigate the integration of technologies in the school environment from the perspective of media ecology. It presents a qualitative study undertaken at eight public primary schools at the city of Rio de Janeiro, Brazil, involving 80 research subjects, including teachers, principals and educational supervisors. The results show the difficulty school actors have in recognizing and dealing with technology's presence at school.

Keywords: ecology, communication media, school culture, technology

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Introduction

The rhetoric of school innovation increasingly focuses on Information and communication technologies (ICT), as a solution for all the present challenges for education. In the past decades, this deterministic and reductive approach has caused the failure of several policies and public initiatives aiming at digital inclusion and technology integration in education.

Recent studies have emphasized the need for an ecological perspective and a broad educational change, where technology is one part of a more complex transformation process.

In this article, we argue that technology integration in education is obstructed by systemic challenges, rather than technical ones. In accordance with the theoretical perspective of media ecology, we understand technology as an environment, which appears to be in a continuous process of modification. On these grounds, we defend that the appropriation of technology in school follows a cultural immersion of all actors involved.

The study here presented seeks to examine contextual elements favorable to the integration of ICT in eight public primary schools in the city of Rio de Janeiro, Brazil. The main purpose of this investigation is to explore the relationships and synergies between school managers, teachers and other school actors.

The methodological approach taken in this study is a qualitative methodology, which addressed specific topics, considered important descriptors of the school context: teachers' perceptions of technologies; the relationship between teachers and students through social networks; the role of supervisors in the integration of ICT in teaching and learning practices.

The findings provide an important opportunity to advance the understanding of the elements that are most likely to generate sustainable cultural processes of ICT integration in schools.

Media ecology: a theory for Education

In the attempt to reflect on the transformations of a pressing nature in our current educational scenario, marked by the significant contribution by technology, we find we must turn to the interpretational perspective of reality from the point of view of *media ecology*. The concept of a media ecology was coined by McLuhan (1962; 1964), but was officially presented to the public in the year 1968 by Neil Postman, who defined it as "the study of media as environments" (Postman, 1970, p. 161). The term was taken from the field of biology, to make people conscious of the fact that human beings live in two different kinds of environment: the natural environment, contemplated by biology, and the communication environment, which is composed by

languages, symbols, techniques and machines that "make us what we are" (Postman, 2000, p. 11).

McLuhan claimed that we ought to address the media without trying to judge them as positive or negative, as this effort would distract us from truly understanding their influence on us. He affirmed that human beings mould media artefacts at the same time as they are moulded by them, in a process fully marked by interaction. His most famous aphorism – "the medium is the message" – suggests that regardless of its content, media have their own intrinsic effects on our perception and relationship with the world. McLuhan himself, in an interview, when asked to explain his statement, clarified: "When I say the medium, the medium of dissemination, this relates to the effect of this medium on society as a whole, to the way in which it transforms everyone. This is the message, and not its particular effects" (McLuhan, 2011, p. 3).

Each technology triggers relationships and connections between different spheres. Affirming that the medium is the message means that, by transforming the human interaction, as well as communication and social dynamics, each new medium creates a new environment, which alters vastly the culture of its time. Therefore, we are surrounded by invisible environments, in which we find ourselves immersed, in the same way, as a fish is immersed in water and does not realize it (Wallace, 2005).

Understood in this way, media are also extensions of man. Interpreting them in this way means that, far from being merely instruments or tools of which man makes use, media are a sort of elongation of the human being, of its body and of its way of thinking. They are forms of representing a way of learning about the world. In the words of McLuhan (1964, p. 63): "any invention or technology is an extension or self-amputation of our physical bodies, and such extension demands new ratios or new equilibriums among the other organs and extensions of the body. There is, for example, no way of refusing to comply with the new ratios or sense "closure" evoked by the TV image. But the effect of the entry of the TV image will vary from culture to culture in accordance with the existing sense ratios in each culture."

In the view of the author, the use of any medium changes our senses, as a result of the extension of our physical and nervous systems. The extensions are neither technological substitutes, nor mechanical aggregations, but rather sense effects, which is equivalent to saying that these extensions are of a predominantly cultural dimension, since they are a symbolic (re-) organization of man.

Following the course shown by McLuhan, his pupil, Walter Ong (1982; 2002), studied oral and written communication, the characteristics of each model and their impacts on human cognition. In his best-known work, *Orality and Literacy*, originally published in 1982, Ong presented thought and

expression by both forms of language, analysing their differences as communication resources. According to the author, the learning of writing has a sensorial and cognitive impact, transforming not only the word and its use, but also the forms of thought. The repercussions of this transformation throughout society are augmented even more with the written word, pointing to the evolution of the analytical and interpretational abilities of readers. Although his focus is clearly on the contrast between oral and literate cultures, Ong also discusses the universality of speech, the distinction between the alphabet and other systems of writing, and the relationship between orality and electronic media (Strate, 2004).

Based on these considerations, the author refers to media ecology as a theoretical perspective with an interest in the environment, almost a new state of consciousness, which may reflect the uneasiness that led Charles Darwin to outline the system of human evolution. This is the contribution of media ecology to the study and understanding of culture as the environment in which human symbols and their relations are created and evolve. "Our present fascination with ecology of all kinds is tied in with the information explosion that has marked our age and that has made us more conscious of the interrelationships of all the life and structures in the universe around us. With our more and more detailed knowledge of cosmic and organic evolution, ultimately of interrelationships as building up to and centering on life, and eventually human life." (Ong, 2002, p. 6).

According to Ong's definition, media ecology is viewed as an "open system", capable of incentivizing creativity, freedom and the discovery process, although it is necessary to highlight the complexity involved in mapping the system itself. Much more than a metaphor borrowed from the area of biology applied to the study of media, media ecology is a fertile theoretical and epistemological basis in the field of research on new technologies. It features at its core the premise that media, in the condition of species that co-exist in an ecosystem by way of relations and interactions, constitute the surroundings, which give rise to significant changes in society.

If McLuhan's and Ong's approach focuses mainly on custom, actions and activities that the human-media relationship stimulates, Neil Postman's emphasis on media ecology is placed in the possibility of using this conceptualization as a field/method of research, above all for the area of education. According to Postman (1970; 1998; 2000), technological change is not just additive and cumulative, but marked by a dialogical relationship between objects and subjects that define an historical age. The emergence of a new medium does not just add something to the existing system, but changes everything and causes an impact to the entire environment, in a wide-ranging way. It corresponds to an ecological change.

The importance of human beings' action and attitude over the technological tools and authentic learning process over transmitted information are central themes that Postman explored throughout his life as a teacher and thinker. Over thirty years after the first appearance of the concept of media ecology, in 2000, at the inaugural Media Ecology Association convention in New York, he stated: "we put the word 'media' in the front of the word 'ecology' to suggest that we were not simply interested in media, but in the ways in which the interaction between media and human beings give a culture its character and, one might say, help a culture to maintain symbolic balance." (Postman, 2000, p. 11).

Nevertheless, what distinguish Postman's perspective from McLuhan's is that he does address the media with a moral or ethical judgment. Thinking about media, affirms the author, means thinking of what is their good and bad in the prospect of their humanistic consequences. The moral implications of his analysis take him to ask questions such as: "To what extent does a medium contribute to the uses and development of rational thought?", "To what extent does a medium contribute to the development of democratic processes?", or "To what extent do new media give greater access to meaningful information?" (Postman, 2000). To answer such questions, we shall first define what rational thought, or democratic processes mean, and what is significant information. In other words, Postman presents media ecology as a research area of humanities, which is interested in understanding the profound implications of the presence and action of media for all the human spheres.

Applying these thoughts to the field of education, Postman and Weingartner (1969) state the need to subvert the school structure and teaching: "schools must consciously remake themselves into training centers for 'subversion'" (Postman & Weingartner, 1969, p. 10), affirm the authors, and they justify their claim with three main reasons.

First, the communication revolution that has happened in the last century modified our habits, behaviors and beliefs to the point that we would not be able to survive one single day, in the absence of all the media that we got used to possess and use in our daily lives – from TV to electric lights. "You cannot reverse technological change. Things that plug in are here to stay. But you can study media, with a view towards discovering what they are doing to you" (Postman & Weingartner, 1969, p. 11). A first reason for the subversion of Education is that with the increase of media, a decrease of democratic communication channels has taken place in the last century. In Postman's speech at the inaugural Media Ecology Association convention in 2000, he reinforces this statement, as he says that the Internet is a medium that encourages isolation and that the new individualistic practices – such as listen-

ing to music alone, watching videos alone, shopping at home, etc. – foster an imbalance, which, ultimately, has a negative influence on democracy.

Second, a subversive role for the schools is necessary since our age is facing a new phenomenon, which Postman and Weingartner call "the knowledge explosion" that is concerning every scientific field. "Change is not new", say the authors, "What is new is the degree of change […]. Change changed" (Postman & Weingartner, 1969, p. 14). To face the change rapidity, one has to adapt his conducts, values and beliefs to the new system, continuously. Education is especially affected by this aspect of the contemporary world.

Third, we have to look at bureaucracies as a major problem. In fact, by focusing on the way things are done, more than on the reason why they are done, bureaucracies are, by nature, resistant to change. Their function is to prevent social renewal: "when we talk about revitalizing a society, we tend to put exclusive emphasis on finding new ideas. But there is usually no shortage of new ideas; the problem is to get a hearing for them." (Postman & Weingartner, 1969, p. 15).

The main problem, according to the authors, is that the teachers do not seem to find these issues relevant to their practice. At the same time, the students have internalized a way of thinking and acting that prevents them from any active participation in the learning process. In this way, the only way to update the education system is through subversion.

Approaching ICT as a culture

The rhetoric of school innovation focuses more and more on the use of Information and communication technologies (ICT), as the simplest solution for change in learning and teaching practices. It is commonly believed that adopting ICT in the classroom leads to more active search of information and fosters digital inclusion, giving access to a broad variety of contents and bigger chances to learn. For this reason, it is expected that teachers use technologies effectively.

However, research over the last two decades underlines the simple reasoning that such a way of thinking hides. Assessments of large-scale programs have revealed that technology use in education enhances students' engagement and motivation for learning, but it does not affect their learning methods directly. Students use technology to gather, organize and share information, but this has not dramatically improved their results (Davis & West, 2014; Harper & Milman, 2016; Zheng, Warschauer, Lin, & Chang, 2016). On the other hand, research shows that it is not enough to introduce technology as a new teaching tool to create innovative strategies. Teachers find obstacles in incorporating technologies into their teaching practices, mostly due to a lack of confidence and scarce opportunities of methodolog-

ical training, which they need to review the didactics they use (Pischetola, 2014; 2016). The association of technology with school innovation is found to be a deterministic cause-effect solution, which explains the failure of many programs of technology integration in schools worldwide (Warschauer, 2004). This is why it is essential to go beyond impact studies and to approach technology uses at school by considering the cultural aspects of the technical solutions implementation. Following this idea, recent studies on educational technology integration emphasize the need for systemic educational change to fully identify technology's potential for improving learning and innovating teaching practices (Davis & West, 2014; Dexter, 2011; Luppicini, 2005; Mirra, 2018).

In this paper, we argue that technology integration is a methodological problem, rather than a technical one. In fact, the introduction of technologies in school contexts leads to discussion on the production of knowledge and demands for new teaching strategies promoting the centrality of the pupil and learning through discovery.

In accordance with the forms of thinking fostered by the theoretical perspective of media ecology, we understand technology as culture and, as such, as a creator of environments, in a constant process of evolution and change. At the same time as man transforms technology, man is also transformed by it. This ecological and cultural vision of media - based on the concepts of life, survival and interaction - therefore goes beyond traditional, mechanical approaches - based on concepts such as control, utilitarism, efficiency and power. In this way, it emphasizes that media only gain meaning with respect to other media, as part of a culture, as species that co-habit the same ecosystem of communication, in a relationship of interdependence. In this regard, we defend that studies on technologies and media should occur, above all, based on a cultural focus.

Media ecology arose as a more complex and integrating perspective concerning the study of media, disseminating the idea that media establish cultural environments, alleging that no medium exists or has meaning by itself, but only with respect to others. This relational nature of media highlights that change is above all a cultural, and not just a technical process, since each change in the environment affects media. Likewise, each new medium that arises affects the entirety of the cultural ecosystem.

In light of this, as stressed by Scolari (2012), the time has come to go beyond a mere description and to start to develop theoretical and methodological strategies that go in depth in research on media, in dialogue with social and cultural changes. The author emphasizes the importance of media ecology in the current scenario of research on digital media and technologies, saying that reflections on media ecology are indispensable reference when it comes to understanding the global information networks, as well as

the communication practices online and the emergence of transmedia narratives.

In a context in which every day new media forms proliferate, it stands out that there is the need to look beyond technical elements and their effects, analysing multiple interconnected and interactive dimensions of power, resistance, time and space, sociability, languages and symbols existing in current digital systems. As stated by McLuhan (1964), no medium exists alone or has an isolated meaning, but rather there is a permanent relationship with other media.

As such, it is necessary to take a more careful look at interactions, not just at technical devices, as if they existed in isolation, as ends themselves. We can also not lose sight of the fact that technology is not neutral and, to this extent, its adoption is intrinsically marked by tensions that question, alter and reinvent its use. In this regard, "each technology drives a necessary movement of *cultural appropriation* of the technological medium, including the exercise of creation and access to different forms of knowledge production" (Pischetola, 2016, p. 87). In addition, more than access and technical training, the ubiquity of digital information and communication technologies requires true immersion in this digital universe, marked by new ways of being in the world, new forms of literacy and processes of creation, as well as new forms of thought, as presented by the perspective of media ecology (Buzato, 2010).

In this article, we defend that the school is a fundamental part of this appropriation and reflection process. School is a place of discernment, where people can acquire the right to reflect and interpret the said and the unsaid, the significance and implied meanings of existence. Digital technologies foster mobilization, the establishment of a participative culture, which incentivizes creation, expression and political engagement of actors involved and immersed in this culture. Nevertheless, given the large amount of available information and data, there is the need for education to develop critical and creative learning. This means preparing individuals who will not just passive consumers of socio-technical objects, but aware that they live in the present day, which is a historical, social and cultural construction. Through the dialectics between old and new, and through a continual process of reorganization of social relations mediated by technologies.

By focusing on teaching practices, we believe that the appropriation of digital technologies is a process in constant movement. It involves not just the assimilation of technical aspects of respective use, but also the enlargement of analysis perspectives, the negotiation of convincing criteria for respective use in the school, the understanding of respective application purposes and the development of new skills, in the administration of multiliteracy (Gee, 2009). In other words, we defend that the appropriation of

technologies in school corresponds to a process of cultural immersion for all actors involved.

A research study in Brazilian public schools

These factors point to the need to consider technology in the classroom not just as a tool, but as culture. For this reason, it is crucial to adopt a perspective that comprises socio-cultural changes arising from digital culture. Technology allows collaboration between students, debates for a better understanding of subjects, criticism of content presented in class and incentives for the creation of arguments by students that justify their positions. From this perspective, the cultural challenge for teachers is to establish their methodology for the use of technologies in the classroom, not just by reproducing traditional teaching practices, but also by exploring new methodological approaches. The role of teachers is to arouse interest in students for learning with media, to give rise to debates on the issues raised by media and to establish a relationship between these issues and the experiences of students, thereby encouraging critical reflection, dialogue and intellectual exchange.

The research presented below sought to analyse the strategies for the cultural integration of digital technologies in the school context, based on the comprehension and practice of teachers and supervisors.

Research Context and Methodology

A team composed by four post-graduate researchers from the Department of Education at the Pontifícia Universidade Católica of Rio de Janeiro, coordinated by the author, carried out a study of a qualitative nature at eight public primary schools in the city of Rio de Janeiro, Brazil. The research was undertaken between October 2014 and December 2016.

Qualitative methods offer significant data for the understanding of the investigated field, as they consider the relationship between the researcher and the research subjects as part of the research material. The qualitative approach was chosen with the purpose of observing, getting to know and analyzing the specific situations of the selected school contexts, through a depth analysis that would clarify the process of ICT cultural integration. A variety of aspects were taken into account: the way contact was established between the researchers and the schools, the reception and the availability of the participants to be interviewed, the space where the meetings occurred. All these elements were considered in the transcription and elaboration of the collected material.

The research aimed to examine contextual elements favorable to the integration of ICT in education, starting from the hypothesis that the relation-

ships and synergies between school managers, teachers and other actors is of great importance to reach this goal. Based on this assumption, we identified six indicators to clarify the relationship between the schools and ICT: (1) the perceptions of teachers, principals and pedagogical coordinators concerning the presence of ICT in school; (2) the existence (or not) of educational plans to use ICT; (3) the support / incentive from the school management of the use of ICT; (4) the existence (or not) of infrastructure maintenance and technical support; (5) the internal relations between the school actors; (6) the relations of the school with the network of external partners (parents, university, institutions, NGOs, etc.).

We aimed at selecting schools located in areas of the city with different socio-cultural contexts, which corresponded to three initial criteria: (1) implementing projects involving different types of technologies; (2) use ICT for interdisciplinary projects and with potentially innovative practices; (3) continue to use ICT over time. These criteria were defined based on previous research results, which had shown us how the main challenges for the integration of ICT in the school context were linked to specific elements of the institution and partnerships (or lack thereof) among who worked there. In particular, the third criterion, of the continuity of the use of ICT, deserves to be highlighted as a characteristic that indicates, in general, the presence of more than one teacher who uses the technological tools actively. In fact, the results of previous research have indicated that the presence of a group of teachers working with ICT describes a situation more effective to the continuity of use of ICT.

A request was sent to the Department of Education for identification of 10 schools that met the three criteria mentioned above, but only eight were indicated as suitable to be included in the research. Each researcher was responsible for carrying out the study in two schools, distributed according to criteria of geographic proximity.

The research used two instruments for data collection: (1) semi-structured interviews with 64 teachers (eight in each school, selected randomly) and 16 supervisors (principal and teachers' coordinator of each school); (2) participant observation in the classrooms (two teachers at each school for a period of 12 weeks), focusing on teaching practices with the use of technologies, based on a spreadsheet of initial indicators to be observed (among them, the activities proposed by the teacher, the teacher-student relationship in the classroom, the involvement and motivation of students and indicators of collaboration and mutual aid).

With regard to the interview instrument, a series of questions was created to guide the conduct of the interview by the four researchers. The definition of the questions arose from different research focuses, within the general framework: each researcher chose two questions to be inserted in the
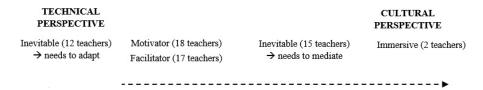
interview script, with the result that in all the schools questions were asked pertinent to the defined research topic. The four specific topics were thus defined: (1) teachers' understanding of the concept of digital literacy; (2) the relationship between teachers and students through social networks; (3) the perception of technology as a tool/cultural artifact; (4) the role of school managers in the pedagogical integration of ICT. In the following section, we present a summary of the main findings, with a focus on the elements that we consider most likely to generate sustainable cultural processes of ICT integration in schools.

Main results

As a reference for devising the data analysis methodology, we adopted *Grounded Theory*, created by Glaser and Strauss in 1967, consisting of four steps: empirical data collection; procedures for coding or analysing data; open coding, axial coding or concept formation and development; selective coding or modification and integration of the concept and delimitation of the theory. The methodology, which is extremely effective but not often used in Brazilian studies, focuses on the data produced in the field, with the purpose of generating explanations for individuals' actions within a social context of study. It was chosen because it allows for a systemic analysis of the contextual social interactions, and ICT cultural integration.

The data was analysed in an attempt to find the patterns that most closely fit in the concept of culture, even those most distanced from it, based on an imaginary *continuum*, which can be represented visually as follows:

Figure 1: Patterns of perceptions that most closely fit in the concept of ICT as a culture

TECHNICAL PERSPECTIVE			CULTURAL PERSPECTIVE
Inevitable (12 teachers) → needs to adapt	Motivator (18 teachers) Facilitator (17 teachers)	Inevitable (15 teachers) → needs to mediate	Immersive (2 teachers)

Teacher perceptions of technologies. Source: the author, field research.

Based on the collected data, we observed that, in general, the surveyed institutions demonstrate some concern regarding the inclusion of technologies, providing resources and schedules seeking accessibility. However, the cultural perspective is not prioritized. Most of the interviewees recognized the importance of technologies for school innovation at the current historical time. At the same time, the reporting of teaching practices and observation in the classroom revealed the difficulty of applying these convictions to daily teaching work.

Based on the analysis of the interviews, and relating it to the theoretical perspective of media ecology, we noticed that, out of the 64 interviewed teachers:

- 27 teachers declared that technologies are "something we can no longer avoid";
- 18 teachers referred to media at the school as "a motivating aspect for students";
- 17 teachers considered technologies "a facilitator, an aid for the teacher";
- Two teachers described technologies as "an environment in which we are immersed". Find below a brief description of each category found.

a) Technology as something inevitable

A large proportion of interviewed teachers (27) reported that digital technology is an inevitable agent of change for society and therefore the school needs to change. Among them, we recognized two different approaches, one more pessimistic and another more optimistic. In the first category, we found 12 discourses that pointed to differences in this generation, suggesting that students are able to use technologies easily, "they know a lot", "they are almost self-taught" and that teachers, on the other hand, are resistant to change and do not know how to adapt. Find below the testimonies of two teachers who answered the question: "What is the relationship between media and school?":

> In my view, it is an extremely important relationship, because the generations of students coming nowadays are already a part of it. I usually even joke with them, saying that they are born with a chip. So, they are born already a part of this; they already handle technologies and media in general, they already handle them with considerable fluency. Without any training course, with no need to instruct them on this. They end up learning by themselves. One gives advice to the other, and they end up exchanging, playing around and learning. And we end up having some resistance to this (Mathematics Teacher, school 08).

> It is a necessary relationship, currently. It is not even optional, something we can choose, because it invades to a certain degree our daily life (Portuguese Language Teacher, school 01).

In these discourses, it is evident that there is a sense of inadequacy among teachers, who realize that their traditional teaching practices are considered increasingly obsolete, but, at the same time, they do not know how to update them. It is interesting to note that many of the interviewed teachers do not feel responsible for teaching young people to select content and to use the Internet, only giving responsibility to families for this task.

The other 15 teachers included in the analysis category that we call "inevitability" recognize that change is happening, but propose that, precisely for this reason, the school should recognize its role as mediator between students and technologies, from the perspective of teaching students about the best use of these tools. These teachers claim that students do not know how to make "proper use" or "right use" of the search tools and content provided by technologies. Here is an example:

> One cannot ignore it. One just cannot do a 100% virtual class, but at some point you can use this virtual to your advantage, because from now on I believe that teachers will not be excluded - I have colleagues who say: "Ah, we will be replaced." We will not be replaced, because even with the Internet it is necessary for there to be a mediator, because children are bombarded, and they let things go unnoticed, as we also do. It is because it is very fast, and with this speed, we can learn something (Reading room teacher, school 04).

The research results show that most interviewed school supervisors also have this view: teaching the "right use" of technology is the only way to actually encourage cognitive effort that contributes to learning, under which other activities are not considered ways of learning. Is there a "right use" of media? What other forms of use and appropriation are excluded from that comprising the "right use" of media? What other ways of learning and interacting with knowledge are ignored as to all their potential?

b) Technology as a motivating factor for students / facilitator for teachers

A large number of teachers referred to technology as a "recreational resource" or "incentive" for students (18), or as a "facilitator" for teachers in their teaching (17). Although these approaches sometimes feature some interesting ideas on teaching work, one notes that they still refer to a very technicistic view, which regards the media as a teaching aid and not as a cultural element. That is, it is believed that just due to their presence in the school environment, technologies motivate students or are able to help teachers.

> We currently work with an audience that has very little interest in learning. And media nowadays, it helps focus on something. I did not mean that it actually improves their learning, but it is a stimulus for them to start moving forward (Mathematics Teacher, school 08).

In the classroom observations, it was clear that often teachers who viewed technology as a technical aid did not change their traditional teaching practices. Instead of using the blackboard, they simply projected their presentations using PowerPoint, not for this reason achieving more participation and/or interest on the part of students. Therefore, we believe that this vision of technology as a motivating/facilitating factor in the classroom

is the other side of the coin from lack of confidence among teachers with respect to changes in the present world and to the inadequacy of their teaching practices, in constant competition with the technologies, more alluring according to them.

c) Technology as an environment in which we are immersed

In (only) two cases, the interviewed teachers' statements featured perceptions of technology as a cultural environment in which society is immersed. In these discourses, the difference between technology and any other cultural artefact is not established. Technology is simply a factor that is part of everyday life, part of our relationship with the world. In this regard, a school that truly integrates technology is an environment that does not stand apart from life, not distancing itself from the outside world, nor from the reality of students, since everything - practices, social relations, access to information, construction of knowledge, communication and learning - is part of the same reality, constituting an ecosystem of shared meanings.

> I think that school, like media, is a producer of culture, so children are part of the culture here at school. The media contributes a lot to them and there is no way the school can escape from what the media contributes. We want to be part of a school culture in which children behave the way we think it should be, but we cannot escape what is part of their daily life and media is very present today. And I think that at school we have to help children take a critical look at the media, to make them realize what media is saying to them, and based on that, what they can take advantage of or not, and to make them aware of what the media is saying and what it really is, so they look at the world with different eyes, otherwise they end up looking at the world only through the eyes of the media. But we have to always relativize, always problematize, so children bring questions to us all the time, because they saw it on the Internet, or that they are seeing on their mobile phone, it is a new game that has appeared. I use *data show* in the classroom a lot, so sometimes when they bring something new, sometimes I put it on the *data show*, I show it. When they talk about some video, something, or some new subject, we go there on Google and search, but we end up using it collectively, because of that, because there it is in my classroom. I bring my computer, with my Internet, then it works, there is no mistake. And I think that is what our role is, to question, so that they can look (Primary School Teacher I, school 05).

> I think it has a lot to do with the world that people live in. The changes we have undergone in the world are kind of becoming part of the changes we have to make in school. I think nowadays anyone has a mobile phone on the street. Nobody leaves home without a mobile phone. I think this change in the classroom is starting to be made

> now, kind of taking the first steps. It's … kind of like we've made some
> headway in this, but it's still a taboo for some teachers, some schools,
> in general. I believe that (Mathematics Teacher, school 06).

In short, with regard to the proposition assumed by the research that the insertion of technologies into the teaching-learning process entails going beyond the view of technology as a tool, and accepting the need for cultural change in teaching, it can be said that most of the interviewed teachers value technologies because of their multiple technical features, but few accept the possibility of changing the teaching-learning process based on their use.

A technical perspective prevails over a cultural perspective

The collected data confirmed the need to emphasize, in the process of teacher training, debates and awareness raising among those involved regarding the importance of the appropriation of technology from a more cultural and less functional perspective. We perceived the need to value spaces of mutual questioning between teacher and student, fostering critical reflection on teaching and at the same time student awareness, with activities focused on the stages involving the participation of teachers in the planning, development and evaluation of strategies for change, with respect to the concept of digital inclusion and the integration of technologies in teaching methodology.

As such, the obtained results allow us to conclude that there is a need to find other ways of teacher training, which lead to transformative learning, capable of giving rise to structural change in the basic premises of teachers' thinking, feelings and actions. It is a need for a change in consciousness, dramatically and permanently altering one's way not only of dealing with technology with respect to education, but also of being (and perceiving oneself as) immersed in the culture of today's world.

The reflections by Postman and Weingartner (1969) on the crisis in school institutions and the urgency of adapting to the new times are as current as when stated in past decades. As concluded by Norbert Wiener (1954), we have changed our environment so radically that we now have to change ourselves too, in order to exist in this new environment. Historically, there is a need for change, which often fails to materialize, especially in the educational field.

As the media ecology perspective shows, a change in a medium is never linear or additive, only cumulative. The introduction of a new technology affects the whole medium. That is, a new element changes the whole of the environment, resulting in a completely new environment, which presupposes, as such, the (co)existence of new standards, perceptions, understandings and strategies for survival and adaptation. In light of this, why not announce, as

the authors, the "need for a new type of Education"? Education that learns from the past, understands and demystifies the present, and points to a future without fear and dread. Education that aims to produce inquisitive, flexible and creative students, capable of facing uncertainties and crises in contemporary society. Education that seeks the motivation and the real interests of the students, not letting the presence of technologies in the classroom replace the teachers' mediation. Education that produces critical and conscious students, who do not need to learn the "right use" of technologies and may be guided by more fundamental values learned at school. Education that is not afraid of the comings and goings along the way and that recognizes the ways and the wisdom of the time are a two-way street.

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