A LOOK AT THE CHALLENGES IN THE TRANSITION FROM ANALOG TO DIGITAL EDUCATION IN THE POST PANDEMIC ERA

Mercedes Velásquez Jaramillo*
Rosa Lia Mafla Educational Institution Jamundi, Valle- Colombia
Jamundí, Valle- Colombia
mercedesjaramillo.est@umecit.edu.pa
https://orcid.org/0000-0002-3339-4291

Marisol Mendoza Molina**
Cucuta National Technical Institute of Commerce, North of Santander- Colombia
marisolmendoza.est@umecit.edu.pa
https://orcid.org/0000-0002-6038-4718

Tomas Alfonso Pallares Quintero***
Juan Frio Agricultural Technical Educational Institution, Colombia
tomaspallares.est@umecit.edu.pa
https://orcid.org/0000-0001-6047-269X

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ABSTRACT

This article seeks to review some of the challenges facing education in the post-pandemic period. Facing COVID 19 caused global confinement and trauma in all public and private spheres around the world, and education is no stranger to this. In Latin America, particularly Colombia, the lack of preparation to face this situation was noted, due to the minimal investment of governments in education. In particular, four challenges are addressed. The first refers to the updating of the educational paradigm, showing that schools were lagging behind in the assimilation of the new digital reality. The second, the need to educate students in socioemotional competencies in order to be active agents in learning. The third, the active incorporation of technology in education where the importance of the use of new Information and Communication Technologies (ICT), digital platforms and the benefits they offer to the school is expressed. The fourth section takes a look at the educational infrastructure, especially the digital one, in public educational institutions in Colombia, criticizing national educational policies, compared with some advances in the region.

* Doctoral student in Education, UMECIT University. Master in English Didactics, Caldas University - Manizales. B.A. in Foreign Languages English-French, Valle University- Cali.
** Doctoral student in Education, Universidad UMECIT. Master in Educational Technology Management, UDES. Specialist in Educational Informatics Administration, UDES. Bachelor's Degree in Biology and Chemistry from UFPS.
*** Doctoral student in Education, UMECIT University. Master in Education, Simon Bolivar University of Cucuta. Bachelor in Teaching with emphasis in Technological areas, Francisco de Paula Santander University, Cucuta.

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INTRODUCTION

The pandemic that started at the end of 2019, whose end cannot yet be precisely dated due to the appearance of new strains and outbreaks, has posed challenges for different sectors: health, economy, social exchange. However, as an entity that transforms societies, education bears the greatest responsibility for the challenges it faces. But it cannot be left aside, as Ramos (2018) states, that the processes that are woven within society correspond to *"complex, interconnected, dynamic and multifactorial systems, where reductions of any kind do not allow a finished analysis of the dimensions that need to be considered for its improvement"*.

In the post-pandemic context, the challenges of education respond to two differentiated but interconnected dynamics, taking into account its dual role in society. In the first, education is understood as a space deeply impacted by the pandemic that forces to make intrinsic structural modifications in its usual teaching and learning processes. And in the second one, by limiting Freire's (2012) thought about education transforming the history of peoples, through its historical subjects, education is perceived as the space to cement and transform societies by providing its members with tools that allow them to act critically and reflectively in times of high tension and uncertainty such as those implied and still implied by the pandemic.

The challenges faced by society at all times in history, but particularly in the post-pandemic period, are due to an interconnection of processes: social, political, economic, public health, among others. However, a reductionist vision has placed on education, at different levels, the responsibility of forming citizens who are able to manage their emotions, to regulate their learning, to assess and evaluate the information they consume and disseminate, to take responsibility for their actions, to recognize themselves as being in society, subject of rights and agent of duties.

Therefore, considering the profound transformations that have taken place within the school, in the teaching-learning process itself during these two years, it is projected that the school will continue to be both receiver and transmitter of great challenges, the greatest of which implies the responsibility of forming the subjects that will face and confront the challenges to come. As stated by ECLAC (2021) *"if this crisis is not taken as an opportunity, the social, cognitive and digital gaps that are of so much concern will inevitably deepen in the coming years"*. Education is in

direct action with the first two gaps and it is up to it to direct efforts to reduce them in the post-Covid era. Thus, there are four fronts on which educational agents must work in order to strive for a more equitable and inclusive education, in line with the changing times. Namely, updating the educational paradigm, curriculum permeated by socioemotional competencies, active incorporation of technology in education and an analysis of the adequacy of the technological infrastructure in Colombia.

UPDATING THE EDUCATIONAL PARADIGM

The first two decades of the 21st century witnessed a technological innovation that allowed, to a greater extent, the interconnection of a globalized world. This innovation entered our lives with strong and lasting steps: it is not possible to conceive a day in life without using a smartphone. Today's world is global, digital and constantly changing. However, as Fernandez (2020) puts it, "the school was designed for a national, printed and predictable environment". The school did not show signs of keeping pace with this accelerated change and, at least in primary and secondary education in the official sectors, did not process this new informational ecosystem fluently and even less incorporated it into its routine tasks.

The pandemic arrived and with it came scenarios never before seen or foreseen. From one day to the next, the school was forced to update twenty years behind. This modernization does not only involve the incorporation of Information and Communication Technologies, it mainly entails a readjustment in what we understand by education, why and for what we educate, how we educate, who we educate, tending towards the development of teaching practices favorable to a new ecology of learning in the context of the Information Society (Coll, 2018). It is necessary, then, a change or a profound update of the educational paradigm we have been living. If, as Durkheim (cited in Delval, 2013) pointed out, the function of education is the systematic socialization of the young generation, this generation is living socialization processes, mediated by technology that differ, and it could be said that they are ahead, of those that their teachers have lived.

This forces us to think of the classroom as a space where the student brings into play everything that defines him as a being, and in the digital era, the student is an active consumer of technology and digital information. So, in this educational paradigm shift, what happens inside the classroom must "prepare our students to function in a rapidly changing society. It must teach them to learn and adapt to changing situations" (Delval, 2013). Likewise, what happens in the classroom, be it instruction, education, exchange, coexistence, meeting of knowledge, among others, must account

for what happens in the real world. In today's real world there is an exchange of information that is not always truthful, some of it is ill-intentioned, and some, perhaps beneficial, is passed over. It is then the function of the school, immersed in the interconnected digital world to offer an integral and quality education so that the inhabitants of society can "enjoy or suffer in the daily chores of life; being influenced by the values they assume and the reflective attitude regarding their current situation" (Blancas, 2018). At this moment in history, this comprehensive and quality education requires new literacy processes, no longer alphanumeric, but in skills for the acquisition and management of information and knowledge stored in search servers.

The pandemic and the times to come present, once again, a scenario par excellence to make this update evident and perhaps tangible. According to UNESCO (2020), albeit unexpectedly, a point has been reached where it has become imperative to collectively rethink the purposes of education and the organization of learning. However, a paradigm shift or update is not done individually, it is done collectively involving the affected entities in the first person. Already the period of virtual or distance education took a first step in this readjustment, allowing teachers to support each other in more digitally competent teachers or students with advanced knowledge in ICTs. The challenge for teachers is not to put aside the spirit of cooperation that emerged during the height of the pandemic and to promote the creation of study and support networks that lead to greater professionalization or qualification of the teaching work in the context of a digitized and interconnected world.

Likewise, these learning communities arising from the need and will of teachers and students, rather than imposed by reform creators, would contribute to the updating of the educational paradigm, assimilating and incorporating into classroom practices the digital reality of which the learners served in educational institutions are a part. The school has been indebted to this updating since the dawn of the 21st century, since one of the great barriers that virtual or remote education posed more than the deficit or lack of technological facilities was "the certain way of understanding the school, still closer to an analog than a digital society" (Pozo, 2020).

In the collective construction of this digital vision of the school, it is not enough to digitize in Word or PDF format the printed pages of the textbooks that are usually used. Technological adaptations could be considered as a first step, but this is not the ultimate goal. It is necessary to generate forms of interaction and scenarios different from the usual ones, scenarios in which technologies are the means, but not the educational end (Cabero and Barroso, 2015). In this sense,

it is necessary to create learning opportunities from and for the digital reality for students who are natives of technology 2.0 migrating to 3.0, since the teacher is no longer a transmitter of content, but a promoter of learning. Of course, not all teachers are engineers or programmers, but they are receptacles par excellence of curiosity, creativity, resilience and innovation, which enables them to adapt to this change by resignifying their educational practices. In this re-signification, the intentions, objectives and reflections of teachers become more relevant, requiring the structuring of a personalized curriculum, oriented to the resolution of situations and problems, promoting and facilitating the realization of meaningful learning in the digital era (Nogueira, Engel, Coll, Lopes 2021).

Educating for life has always been on the school's horizon, however, educating for life in this liquid generation (Bauman, 2007) implies the teaching of values and learning that allows students to develop competently in both analog and digital reality. Society has values that allow coexistence, built on the physical plane, and the school seeks to promote them in its daily work. However, those values are not necessarily or exactly replicated in the digital plane. It is up to the school to assist the current and future generation in the construction of those values that will allow a respectful, responsible, self-regulated and proactive behavior, within all the freedoms of the virtual world, in this new scenario.

Curriculum permeated by socioemotional competencies

Life is multidimensional, so is the educational act and the entities involved in it. The pandemic, which initially appeared as a health problem, radiated to all levels of society without distinction of any kind, revealing the multiple areas that a particular event can affect. In this understanding, it is at the heart of the school the need to train their students, not only in the understanding of this multidimensionality, but also in the management of actions in accordance with it. As stated by Delval (2013), the school, in addition to teaching disciplinary knowledge, must focus its efforts on teaching how to learn and adapt to changing situations.

In this teaching to learn and to adapt, and from the field of emotion management and self-regulation, the school evidenced to be in debt with the generation that currently educates, as evidenced by a study conducted by Lorenzo et al. (2021) "the competence of learning to learn, to work with autonomy and self-regulation was not sufficiently promoted before the pandemic" and this turns out to be fundamental both in a hybrid teaching model as the one that forced the emergency, and in 'normal' teaching-learning scenarios.

Thus, the challenge for education is to provide students with the foundations that allow them to develop both their intellectual and emotional knowledge. The latter, according to Mayer and Salovey (cited in Davila and Sastre, 2010), is understood as *"the ability to accurately perceive, value and express emotions; the ability to find and/or generate feelings when they facilitate thinking and the ability to understand and regulate emotions to promote emotional and intellectual growth"*. A student who is able to recognize what prevents him/her from learning can more easily take action to remedy the situation. The teaching of this skill is transversal to all disciplinary knowledge and fundamental to the act of educating. ECLAC (2021) considers that a challenge in the pandemic (and of course in the post-pandemic) is education in socioemotional competencies such as discipline, motivation, time management, among others. The development of these competencies facilitates continuous and lifelong learning, providing students with the strategies and consequent actions necessary to be active agents of their learning. They also allow students to develop resilience and flexibility, essential values to perform competently in a world in constant tension, unpredictable and uncertain due to accelerated environmental and technological changes (ECLAC 2021).

In addition to recognizing their emotional dimension, students, in a context of lifelong learning in the post-pandemic, must recognize themselves in their relationship with others and in their projection to society. Thus, the Colombian Ministry of National Education (2017) defines socioemotional competencies as those that allow people to *"know themselves better, manage their emotions, set goals and move towards them, build better relationships with others, make responsible decisions in their lives, decrease aggression and increase satisfaction with their lives"*. It is structural to the teaching processes at school to develop concrete, traceable and measurable actions to foster the development of these skills, since socially and emotionally competent students not only manage the challenges presented by their own learning process, but also contribute to the construction of a more equitable, prosperous, responsible and better prepared society to face the tensions and uncertainties of life.

Also, the educational commitment goes beyond the instruction of specific areas of knowledge, coupled with the digital skills required by technological advances, it is necessary to train in and from ethics, recognizing the great contribution of technology in the understanding of the social and cultural trend of daily life mediated and supported digitally (Vera, Torres and Martinez, 2014). In the same sense, UNESCO (2020) proposes as a necessary measure to overcome the challenges posed by the pandemic (and post-pandemic times) the imperative need to revive civic trust, deepen human empathy and progress in the scientific field, appreciating common humanity. Desirable

behaviors in the members of society who will be responsible for the progress of society. Behaviors attainable to the extent that the members of that society recognize themselves as emotional beings, competent in the management of those emotions and recognize, respect and value those qualities in others.

At the same time, students who are competent in their socioemotional dimension will be able to distance themselves from risky situations that lead them to make decisions that affect their future development. Even in the absence of adults to regulate their behavior, they are capable of self-regulation: allocating time and effort required for academic work, a healthy balance between time dedicated to leisure and recreation and time dedicated to academic training. These students will assume, responsibly, their learning process by developing the actions required to initiate and persist in learning, avoiding school dropout (MNE, 2017), by effectively managing time, analyzing and reflecting on the information they have and disseminate.

ACTIVE INCORPORATION OF TECHNOLOGY IN EDUCATION

In post-pandemic education, technology should be a significant partner, due to its valuable contributions to the transformation of teaching and learning processes, as well as its immersion in the pedagogical discourse, however, it has been challenging and has gradually become a rival that requires attention due to its interesting protagonism in the role of teachers and students in the encounter towards the development of knowledge. For Cabero (2003), its dynamic role has led it to be considered throughout history *"as a living, polysemic, contradictory and significant discipline"* and its appearance urges us to look precisely at its origins.

The descriptions of the beginnings of technological innovation given by Area (2009), who locates its *"roots in the American military training of the 1940s, in which it was necessary to generate mechanisms to train a large number of citizens as soldiers and officers, using instructional programs for the achievement of specific learning objectives"*, reveal the contribution to training and instructional purposes, based on the concerns, needs and expectations of the participants in different contexts, due to the socio-systemic approach of its holistic, integrative and analytical presence.

Over time, the presence of technology has expanded to the human component, as computer resources have become widespread and have reached all users, linking their potential and advantages of use with tools, applications, networks and resources that have permeated both the physical and

symbolic educational environment for the improvement of the conditions of educational action.

The advance of technology has consolidated diverse socialization mechanisms that, according to Telleria (2009), *"stimulate diverse interactions that drive the educational system to offer new alternatives for training, resize the processes of communication, teaching, learning and research",* very relevant to the interests of citizens in their breadth, diversity and inclusion in education.

In the dizzying changing world, when talking about technology in the educational field, the spectrum opens up beyond the increase in the intensity of its use, extending to the benefits offered by technological alternatives to promote learning and in this sense, Momino (2008) states that *"the link between education and technology is not a recent phenomenon, but rather constitutes a permanent feature throughout history"*, i.e., although it is not the only answer to the questions regarding pedagogical practice and the stimulation of students to learn, without completely guaranteeing quality, its incorporation is effective for the effectiveness that has been achieved to date and to open the gap between traditionalism, to make room for connectivism.

And it is necessary to talk about this topic, referred to by George Siemens (quoted by Baron, 2018), when he determines it as "a learning theory for the digital era, which takes as a basis the analysis of the limitations of behaviorism, cognitivism and constructivism, to explain the effect that technology has had on the way we currently live, communicate and learn". So, technology in the distribution of cognition and knowledge makes an intense task in which the teacher is the guide, the facilitator of learning of students motivated by selected and reliable information that is in their hands and with the ability to generate learning environments and carry out processes that develop not only technological competences.

Although there is a feeling that inside the classroom there is a generational mismatch because teachers are immigrants and students identify themselves as digital natives, the real crux of the matter is communication, information, access to it, documentary sources, collaborative work and learning, as such, that occurs through the network and those who have the power to assume such an avalanche.

Two years ago, the interest in this reflection was postponed, however, the confinement gave a jolt to people and institutions, that without expecting it, addressed on the fly, all the commitments procrastinated for too long and taking a leap into the void, began to notice the slight advances that

were increasing, as with the adaptation, the interest in developing, learning and implementing action plans to make traditional educational practices, a mutation, evolution and hybridization and without altering the methodological foundation, to reach a balance with benefit for all.

When resuming face-to-face, the words given at UNESCO by De Pablos (1996) flow again, when he emphasized the urgency of *"having available qualitative and quantitative means of teaching, traditional (such as books) or new (such as information technologies), that education should be used with discernment and promoting the active participation of students (p. 25)"*, in such a way that it remarkably confirms the fact that educational systems in any circumstance must respond to the great number of challenges that the information society addresses them, adding what was stated by Delors (quoted by Guillen, 2008), who mentioned their responsibility for being *"always based on a continuous enrichment of knowledge and the exercise of a citizenship adapted to the demands of our time"* (p. 73).

Indeed, technology shortens distances, eliminates barriers and opens the way to the global village, therefore, *"the efficient, responsible and ethical use of technology should be contemplated within the range of skills to be acquired during education, which is essential for survival, either as a citizen or as a worker, in the knowledge society"*, as highlighted by Ananiadou and Claro (2010).

With the evident favorable and unfavorable changes during and after the pandemic, in the educational context, the affectation led to *"promote the use of distance education systems in which the use of information technologies and other pedagogical and didactic elements are integrated for the training and teaching of users or online students"*, according to Calixto (2011), who also expresses that, the possible advances in *"the use of Blackboards, Digital Tablets and Tablet-PC, creation and management of Teaching Videos and the use of Platforms, Collaborative Environments and Networks and programs for the establishment of Videoconferences"* raise the knowledge and development of skills and strengths of the digital citizen, who develops not only in the academic world, but in any of the environments in which he/she is.

From the board and the scoreboard to the computer and the mobile device, there is a conceptual scenario, in which virtual environments appear, with very particular characteristics, given *"to create and recreate the processes of training, teaching and learning"* (Ardila, 2009). These spaces for the appropriation of information and communication technologies not only within the artifacts of virtuality, but of other classroom components, with the essential interest of contributing

to the teacher's orientation with greater ease of didactic and pedagogical communication when exemplifying, generating an effective, timely and efficient approach, expanding the horizon of documentary, bibliographic and referential consultation, according to Silvio's research (2003).

Given this, there was the opportunity to enter and navigate in various platforms that assumed denominations such as online training, Internet training, tele-training, virtual teaching environments, online courses, virtual campus, virtual learning environment, tele-training systems or technological platforms, supported by distance learning tools such as Moodle, which, according to Marin (2019), allow *"assisting teachers to establish quality online teaching, which supports the learning of the students to whom it is addressed".* This tool facilitates students' execution of their learning, supported by diverse educational experiences.

Therefore, the challenges and opportunities that students and teachers had before and after the confinement, provide a broader vision regarding the creation and implementation of technology and the need to generate educational policies according to a new reality. With the various alternatives offered by new technologies to promote significant changes in the educational field and for research, questions and concerns are raised about the work of teachers, students, their representatives and institutions, supported by state programs, regarding the reflection of existing and new didactic environments towards the construction of knowledge and the development of thought.

The commitment of educational institutions to take advantage and use technological advances, which requires training to know how to discern and analyze critically and taking giant steps in computer literacy and the various resources required by a prosumer of technology.

ADAPTATION OF THE TECHNOLOGICAL INFRASTRUCTURE IN COLOMBIA: 4G TO 5G?

Due to the COVID 19 pandemic, the inequality and the digital gap existing in each of the regions was seen and felt in Colombia. It was observed how the rural sector presented many difficulties in terms of education. Many questions were raised against the national government, since most schools, if not all, have computers or tablets but do not have adequate infrastructure for the challenge that the pandemic imposed around the world. The lack of internet access in rural areas, both near and far from the urban areas of the municipalities prevented the NNJA (children, youth and adolescents) to develop their academic activities of study at home through digital platforms or applications such as WhatsApp.

The health emergency forces the national government to pay more attention to official educational institutions, especially those located in the rural sector, as well as to rethink the educational policy so that the educational sector can reinvent its pedagogical practices around virtuality and, in this way, continue to deliver the curriculum or academic program.

Despite the fact that in Colombia there is a wide deployment on digital infrastructure, this deployment has not been seen to great impact in public schools and colleges. As Herrera (2017), in his study *"The effect of fixed Internet access on Educational outcomes in Colombia"* states:

> *"In this scenario of accelerated technological deployment and coverage expansion, it should be noted that the policies that have enabled the expansion of Internet coverage have not necessarily taken into account the educational and social paradigms, where the classroom has been losing prominence and the possibility of access to information is present at all times."*

This technological deployment that Herrera comments, has not been seen on a large scale in public educational institutions and could be experienced at the time when the national government ordered the educational alternation at the end of the 2020 school year, where the NNJA of the private sector could access school without any problem because they had an adequate technological infrastructure for such alternation. The opposite case was observed in public or state schools where most of the NNJA could not enter alternation because they did not have internet service or it was not sufficient for educational work.

In addition to this, and based on a study conducted by researchers at Michigan State University as mentioned by Martinez et al. (2020, p. 15) *"it is possible to determine that Internet access constitutes improvements in the academic performance of students, including higher results in standardized tests such as SABER. On the other hand, lack of access to the Internet or difficult access to it may be related to low academic results and lower possibilities of accessing higher education".*

Although in Colombia digital points have been installed in the rural sector where the community can access this benefit, this is not enough due to the very low speed with which the internet reaches homes. In some cases, the school is also connected to these points, however, the internet service in them is insufficient for students to be connected at the same time. This also

causes, in addition, that the digital points lose their performance due to the very low signal they offer.

We have seen that every 4 years in Colombia, when a new president is inaugurated, he arrives with new programs for the education sector and, although they try to link the new with what was operating previously, there is always a clash with the models outlined in each government.

Analyzing the history of the *"Computers to Educate"* program on its web page, it has been maintained to date with some positive aspects in the intention of its creation, for example, the provision of computers to educational institutions, which was issued in presidential directive 02 of May 11, 2001.

In this directive, Colombian President Andres Pastrana announced the leap that educational institutions were going to make towards the Internet. Despite the fact that educational institutions were equipped with computers donated by private companies, connectivity did not reach the rural areas of Colombia. Even in the urban area, in some educational institutions that had access to the Internet, it was not sufficient because its speed was very low. Both teachers and students felt affected for the execution of educational activities that required the use of the internet.

In 2010, the government of Juan Manuel Santos launched the *"Vive Digital Colombia"* program, whose purpose was to massify the internet in the country in order to obtain social and economic benefits. One of the purposes was to bring connectivity to the most remote areas of Colombia through digital kiosks (Ministry of Information and Communication Technologies, 2011).

This plan was more focused on internet for the rural population, involving the public school within the same digital kiosks, which students could access, but with great difficulty because the internet speed had to be distributed among all the inhabitants of the community within the same kiosk.

In Colombia the internet is managed by operators of this service, being the most representative Claro, Movistar and Tigo (Ministry of Information and Communication Technologies, 2022). These operators are responsible for bringing the internet to rural and urban areas of the country. During the COVID 19 pandemic, Claro and Tigo operators, through an agreement with the MINTIC,

were quite involved in bringing the Internet to the NNJA of Colombia. Although it was not for all students, students from ninth, tenth and eleventh grades of some educational institutions benefited.

During this pandemic period, the government committed to deliver SIM cards in different departments to ensure internet connectivity, specifying a first delivery in the departments of Atlantico with 2,689 SIM cards; Bolivar with 2,017; Magdalena with 1,601; Norte de Santander with 1,918; and Santander with 3,078 (Ministry of Information and Communication Technologies, 2021).

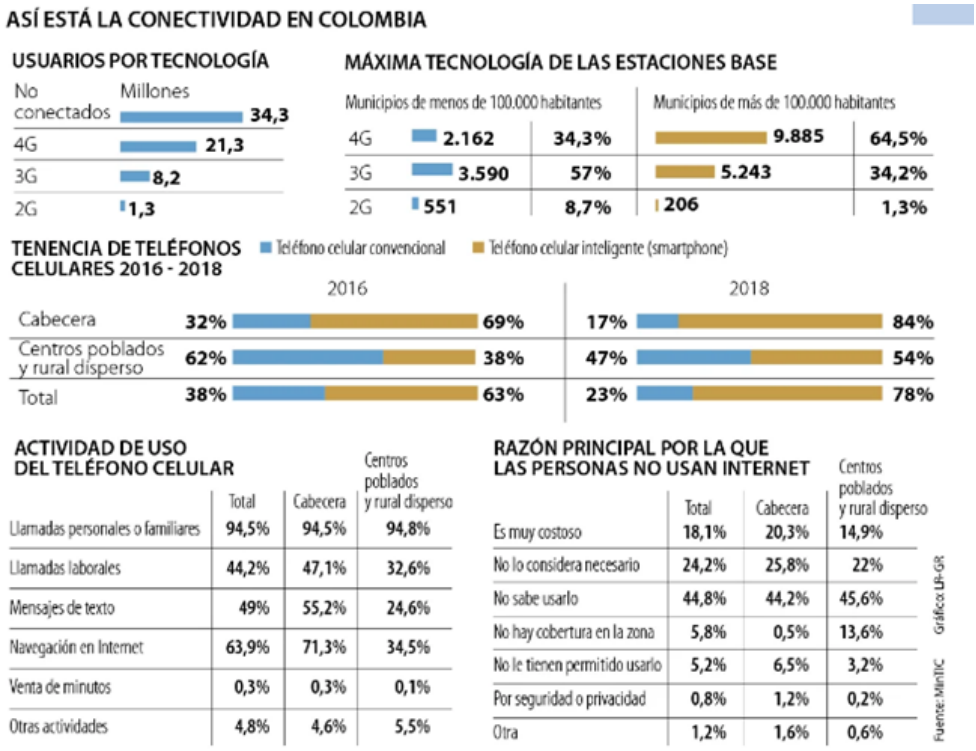
This project to bring internet to the most needy population, especially in the rural sector, was tarnished by the corruption of national government officials and bidders committed to bring internet to families and public schools. The national government had disbursed seventy billion pesos to bring internet to the rural population for the installation of digital points, but these points were never installed.

This case of corruption, as explained by Bohorquez (2021), was denounced by the ICT Ministry itself when it discovered falsehoods in the documents of the contractor of the project, a fact that was revealed by the Colombian press. This investigation is ongoing while the current government is making efforts to bring internet to rural areas in order to lower the poverty and unemployment rates in these areas.

According to Marciales (2020) in an article in the magazine La Republica entitled *"The transition to 4G technology networks in the country would be completed by 2022."*, connectivity in Colombia can be analyzed from the following graphs:

Figure 1.

Connectivity analysis graphs in Colombia.



Note. Adapted from "The transition to 4G technology networks in the country will be completed by 2022". La Republica Journal.

In this statistical table we can observe the digital gap for the years between 2016 and 2018 existing between the municipal capitals and the rural sector. While in 2018, 84% of the inhabitants in the capital city have at least one smartphone, 54% of the inhabitants of populated centers and dispersed rural areas have a smartphone or smart phone.

Despite the fact that in studies on internet coverage Colombia is not doing badly at all, we see that the education sector is very neglected with respect to educational technological infrastructure. In a study conducted by the Digital Society in Latin America (2020-2021) in its report says "the recovery from the crisis generated by the COVID-19 will be digital" it is exposed that, in the case of emerging countries such as those in Latin America, digital transformation is a great opportunity to reshape their economies. This report states that one of the challenges facing society is inequality in populations where internet access is limited. This is due to connectivity and technology (Alvarez-Pallete, 2021).

According to this study, the Colombian population lacks digital skills or does not know how to use the Internet. This is inferred in Image 1, in the lower right table "main reason why people do not use internet" where it is highlighted that in municipal capitals and populated and rural centers between 44 and 45% do not use internet because they do not know how to use it.

According to Zaballos et al. (2019), in a report for the Inter-American Development Bank, in Latin America private investment exceeds public investment in communications infrastructure.

Figure 2.

Cumulative investment in telecommunications

	Inversión				
País	Fija	Móvil	Pública	Privada	Total
Argentina	18092	10505	5484	23113	28597
Bolivia	688	1804	1206	1286	2492
Colombia	8496	11682	3778	16400	20178
Chile	4429	10556	150	14835	14985
Costa Rica	2821	1860	2879	1802	4681
Ecuador	3983	3704	1461	6226	7687
Guatemala	1998	3397	5	5389	5394
Honduras	1934	1520	15	3439	3454
México	30618	17407	9127	38897	48025
Panamá	2241	2317	866	3692	4558
Perú	2529	9525	253	11801	12054
Surinam	190	181	71	301	371

Note. Shows cumulative public and private sector investment in telecommunications.

Source: Zaballos et al. (2019), The impact of digital infrastructure on the Sustainable Development Goals: a study for Latin American and Caribbean countries. IDB.

The pandemic showed that the Internet is essential for the proper functioning of educational institutions and significantly improves the quality of education. It is considered that, although a computer or a tablet without connectivity can be considered pedagogical tools, having internet connectivity in these contributes to the improvement of didactic processes and appropriation of knowledge, which allows reducing the digital gap that exists between public and private education, as Acosta et al. (2021) say *"this has perpetuated the inequality between generations, not because some have access and others do not, but rather because individuals have differentiated access with respect to educational quality"*.

In addition to this, it is necessary to take into account digital literacy for both students and teachers, in order to take full advantage of network connectivity in the classroom. As Mirete (2010, p. 38) mentions, *"there is still a large gap to be closed in terms of teachers' digital literacy. The integration of ICT requires training that is technically, but also pedagogical and methodological".*

Digital literacy, as far as teachers are concerned, enables them to take advantage of all the tools available within the educational environment that allow them to be at the forefront of digital teaching. The national government must continue to bet on rural education, providing technological infrastructure and equipping official educational institutions in urban and rural areas with good Internet coverage.

In one of the web pages of the operator Claro there is an article published *"More rural areas enhance their development with Claro's 4G technology"*, where the company's initiative is presented (Claro Colombia, 2021). Its sustainability program seeks to bring the 4G mobile internet network to rural and remote areas of the country, in order to provide connectivity, access to technology and digital ecosystems that contribute to the development of people and regions. In this way, they promote technology as an engine that transforms lives. The purpose of this initiative is that more Colombians can enjoy the benefits and opportunities that technology and connectivity bring.

Just as private companies reach the rural sector with technology, the national government has the obligation to reach the most distant educational institutions with this same technology, making agreements with the private sector so that they can bring this infrastructure to the most remote public schools and, in this way, improve the teaching-learning processes of the students.

In these post-pandemic times, it is evident that connectivity is a very important factor for the education sector, and that each government is looking for ways to bring internet to educational institutions, where, due to some geographical or political inconveniences, lack of budget or corruption, this service has not been available or has been inefficient due to the low quality or speed of the 3G or 4G network. Local authorities should do everything possible to ensure that children and youth have access to this service and thus improve the quality of education.

With the current infrastructure of 3G or 4G network in the kiosks or digital points, many NNJA cannot develop their activities due to the low speed or power of the network. The phrase

"virtuality is here to stay" is often referred to, but if the digital divide is not overcome, this will remain just words.

One of the realities that the COVID 19 pandemic has left the educational sector is that it is necessary to adapt classrooms to a virtual environment with excellent connectivity, so that teachers and students can access interactive materials downloaded from the Internet with information in real time, all within the same space.

In recent years, the fifth-generation mobile network called 5G has been promoted. This would be a very important leap because it would allow moving from 3G, 4G to 5G which would revolutionize the world of communications, as Flores (2019) comments in an article published in the National Geographic Spain:

> *"The implementation of the fifth-generation mobile network will change the way we communicate, multiply the capacity of information highways and make it possible for everyday objects, from the refrigerator to cars, to connect (with us and with each other) in real time."*

To achieve this, the Colombian government must make gigantic efforts to be able to enter this path of technological revolution and thus bring the 5G mobile network to urban and rural schools and colleges in Colombia. This technology would not only shorten the existing digital gap between public and private, but would also improve the quality of education, this would lead us to have students more interested in research and motivated to explore new knowledge.

Now the question is: how to transcend to a 5g infrastructure taking into account the problems analyzed above? According to Agudelo (quoted in Revista Portafolio, 2022), it should be mentioned that the investment and deployment of 5G networks are a key factor for the economic and social recovery of Latin America. This will contribute to reduce the digital divide, boosting digital transformation by supporting new devices and services in real time, in manufacturing, energy, life sciences and agriculture.

If Colombia makes agreements with telecommunications companies and makes the leap to the 5G network, the existing digital gap between the private and public sectors will be reduced.

The former Vice Minister of Connectivity, Walid David, stated in the virtual event 5G in Latin

America held by the business magazine America Economia, that Colombia is preparing to bring the 5G network to Colombian homes. He also made an analysis of how the region is advancing in the implementation of this technology. The official assured that pilots have been developed for both telecommunications operators and private companies from other sectors to test the technology and structure viable business models (Ministry of Information and Communication Technologies, 2021). This statement is very positive for Colombia, as it exposes that steps are being taken to connect the country with the new generation of the 5G network.

However, looking at other articles that refer to telecommunications we find that although Colombia is making efforts to implement 5G technology, these efforts feel weakened by the high costs generated by this technology. As pointed out by the president of Digital Policy & Law Group, Jorge Negrete, quoted by Lourdy (2022) in an article in Portafolio magazine: *"Although Colombia is the digital thought leader in Latin America, it does not make concrete progress".*

In this same article, Lourdy (2022) mentions:

> *"Among the reasons that would hold the country back, according to Negrete, the high price of radio spectrum stands out, which does not allow companies to make their deployments. 5G needs more spectrum, 10 times more fiber optics and 10 times more radio bases than 4G. But it will be impossible to deploy it because there is no money to be made with those prices."*

In the documents published on MINTIC's website, it is highlighted that the last granting resolutions to carry out 5G network pilots are dated July 2020. Table 1, taken from resolution number 000722 of April 30, 2020 (Ministry of Information and Communication Technologies, 2020), shows the schedule for the granting of permits for the use of the radio spectrum to conduct pilot tests using 5G mobile technologies.

Figure 3.

Permit issuance timeline

Activity	Date	Place
Opening of the call for proposals process	As of the issuance of this Resolution	**Website post:** http://micrositioss.mintic.gov.co/plan_5g/
Closing date for receipt of applications	May 29, 2020	E-mail: **plan5g@mintic.gov.co** **Until 11:59 p.m. on May 29, 2020**
Evaluation of applications, frequency studies and clarification requests	June 01 to 12, 2020	It will be sent to the e-mail address registered in the application.
Publication of the evaluation report of applications submitted	June 19, 2020	https://micrositios.mintic.gov.co/plan_5g/
Issuance of resolutions granting permits for the use of the radio electric spectrum for 5G technical tests.	June 23 to 30, 2020	MinTIC
Publication of the assignment report	July 1, 2020	http://micrositios.mintic.gov.co/plan_5g"

Note. Schedule for granting permits for the use of the radio spectrum to conduct pilot tests using 5G mobile technologies. Taken from resolution number 000722 of April 30, 2020.

Taking into account the aforementioned resolution issued by the Minister of Information and Communication Technologies, it is concluded that efforts are being made for Colombia to enter the new era and revolution of technology, but due to economic drawbacks as mentioned by Negrete quoted by Lourdy (2022), Colombia is lagging a little behind the forefront of the 5G network.

Regarding this, Yuli Andrea Alvarez Pizarro, a professor of the Telecommunications Engineering program at Universidad Santo Tomas de Bucaramanga, quoted by Lourdy (2022), states that according to international organizations, the projection is to have Colombian users in 5G in 2025, but factors such as the pandemic, the delay in the auction and an election year, this time could be extended. However, priority should be given to connect the whole country in 4G.

However, according to the head of the ICT portfolio, quoted by Noguez (2022), efforts will continue to be made to generate the best alternatives for 5G technology, since it is an integral construction on different fronts. Everything indicates that Colombians must wait for the arrival of the new president to see what programs he will have in his government plan for the education sector with respect to connectivity in the urban and rural sectors of the E.I. It is expected that the new president will be able to improve the quality and access to the current 3G and 4G networks while waiting for the arrival of the implementation of 5G in Colombia. In addition, this new government should pay more attention to the digital infrastructure in the public E.I. of the country.

The quality of education is not the responsibility of a single entity; since it transforms society, it must be an active part of it. Thus, the new post-pandemic reality requires that all the organizations that make up the educational community, the regulatory bodies, those in charge of designing educational guidelines and providing adequate infrastructure to the country's public institutions assume an authentic commitment that is reflected in real actions where challenges are seen as opportunities for improvement but not as threats.

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