ICT in schools in Brazil: Challenges of implementation, modernization and inclusion of education system through digital media from the perspective of experts from inclusion, education and human rights sectors

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Abstract

This paper aims to discuss some issues about ICT used in the teaching, learning and inclusion process: implementation, modernization, barriers and challenges. Therefore, three experts with extensive experience in three different areas were interviewed: an inclusion specialist, one in computers in education and one in human rights. The data were analyzed using the interpretative paradigm of qualitative research, and presented respondents' experiences of implementing ICT in education.

Keywords: inclusion, ICT in education, learning, people with disabilities.

Introduction

The theoretical construct on the use of ICTs in the global educational context is already established. However, it is necessary in the face of the specificities of the Brazilian educational context to recognize which and how the personalized use will be to meet in practice our national reality. It is necessary to consider the influence of social and cultural aspects and Brazilian diversity when proposing public educational policies. ICTs need to be understood in their broadest sense as emancipatory tools for the individual, as a means of accessing the world whether in the educational or professional field (Lima, Pereira, & dos Santos, 2018).

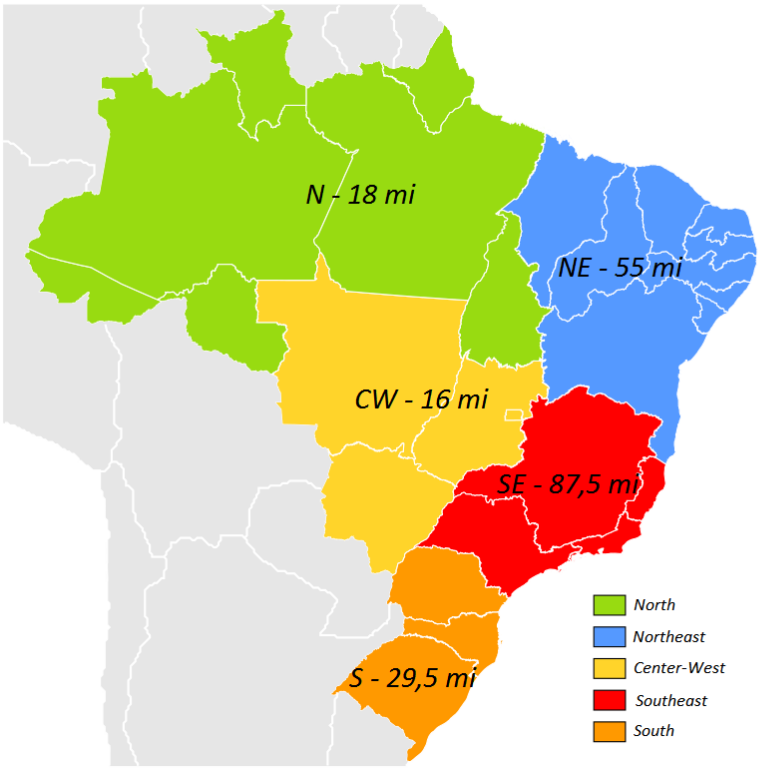
In this scenario, the infrastructure and training of professionals that provide the use of ICTs is far below the current needs of Brazilian education. According to a 2018 OECD (Organization for Economic Co-operation and Development) report, the lack of clear objectives on the use of ICTs for learning, on their integration in teaching practices and the few skills of students and teachers to locate, understand and use quality digital resources in Internet generates a significant deficit between the expectation and the reality of the use of ICTs in the teaching and learning processes (OECD, 2018). Added to this is the lack of technological structure, since often educational institutions, professionals and competent bodies offer few integrative and training actions for the integration of ICTs in educational processes. Sousa (2016) in his study emphasizes that the expansion of the educational scenario is possible by combining the use of new technologies with efficient pedagogical practices. This combination promotes a new profile of active teachers to articulate the processes of communication, socialization, interaction and cultural mediation necessary for today's world.

Based on this context, this study seeks to reflect on three important pillars for the improvement of education, the public sector as a proponent of public policies, the perspective of teachers and students in the teaching-learning environment and technology as an infrastructure that expands and qualifies teaching and learning practices. It is important to emphasize that inclusion appears as a transversal theme in the text because it is already understood as necessary and part of the Brazilian proposal for quality education for all.

Territory and Brazil sample characteristics

Brazil is a huge country in South America, with continental dimensions. Official data from 2019 brings a population with around 210 million inhabitants unequally spread through an area bigger than 8,5 million km^2, having a population density of 22,43 inhabit/km^2, as shown in Figure 1.

Figure 1. Geopolitical division of Brazil in regions



Source: IBGE, 2020.

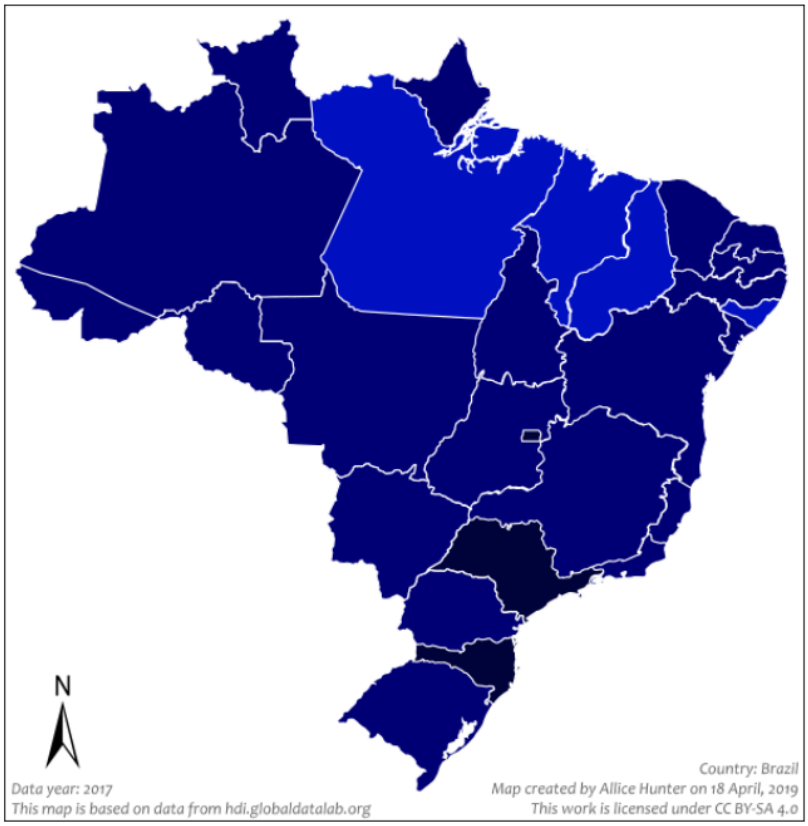
In spite of many inequalities that are common to every developing country, Brazil counts 99,3% of their children between 6-14 years-old in schools, but is still coping with an illiteracy rate of 6,8% (Brazil, 2020). Maybe the only non-inequality that is officially perceived in the Brazilian territory is the language: in practice, the whole country dwells in a single language, the Portuguese, as well as the Brazilian Sign Language (LIBRAS) both are considered the official languages in the country. However, it must be mentioned that there are some native languages spoken by minority groups in some parts of the country.

Despite of not being the capital cities (which is Brasília, in the Center-west region), São Paulo and Rio de Janeiro are the biggest cities of the country, both in the Southeast region, and their metropolitan areas together represent around 35 million inhabitants, which means that 17% of country's population is concentrated in two metropolis.

On the other hand, Brazil has also states and cities with very low population densities. For instance, the Amazonas state, mostly covered by the Amazon rainforest, has 2,23 inhabit/km2. As expected in a developing country, these inequalities go further beyond the population density, which brings reflections in economics, quality of life, education and other aspects of living.

Brazil's HDI (Human Development Index) is considered high, 0.761 (UNDP, 2019), ranked #79 among other countries. Figure 2 shows the inequalities of HDI among states:

Figure 2. Brazil's HDI per state (data from 2017)



Source: Wikimedia Commons

As can be easily seen in Figure 2, Brazilian HDI is unequally distributed, from states with very high HDI (like the Federal district, with HDI=0.85 or São Paulo state, with HDI=0.826) to states with no more than a medium HDI (like the Alagoas state in NE, with HDI=0.683).

Internal inequalities are, in fact, one of the most important barriers to the development of Education and Inclusion initiatives to the countries that face them. For this reason, it is important to have a more holistic, multidisciplinary view about the realities that are presented to these initiatives and how governments, educators, researchers and society could face them. This was the main guiding principle of this work, which is a study based on interviewing agents on the educational processes in Brazil, with distinct backgrounds and experiences, to be able to draw a wider perspective of the challenges that Education and Inclusion have in the Brazilian context.

The study was conducted in February and March 2020 in Brazil. For the interview, three specialists in areas related to education were chosen: a person who works with the inclusion of people with disabilities and the elderly, a researcher and university professor in the field of Computers in Education and a representative of a non-governmental institution in education and inclusion - she is a former public defender, working in the human rights area and minority groups (mainly the elderly and people with disabilities). With these choices it was possible to cover three important perspectives on education, inclusion and technology in the national context.

The first respondent (R1) holds a PhD in Education from the graduate program in Education at Rio de Janeiro State University (UERJ). She works in the area of special education and also teaches internships in inclusive education and human rights. She has worked in public higher education for 12 years and before going to higher education she worked at the private university and in Basic Education, both public and private. She also worked in public education in Distance Learning Center of Rio de Janeiro State (CEDERJ consortium), in the Pedagogy undergraduate course. She participates in community projects for teacher training and technological innovation applied to education. She is also the founder of a Permanent Special Education Forum, which involves researchers and managers in the area of Special Education. Its main research and orientation themes are special education, inclusive education policies in Basic Education and Higher Education, teaching and learning processes for people with intellectual and multiple disabilities, curricular practices, teacher training and technological innovation applied to special education.

The second one (R2) is a university professor, with a background in computing, undergraduate, master's and doctorate and he also has a

degree in Computer Science. He has been teaching Computer courses, basically teaching programming, database and software engineering. He has also been teaching some subjects related to ICTs in Education, this more in the ambit of postgraduate studies. He has been in this career, in this academic position entirely for some 20 years or so, he previously worked as a development analyst. He has been working with ICTs in Education, starting with a doctorate and he has been doing research with ICTs in Education, he has been supervising masters and doctorates, he has participated in projects with the development of tools for education, like games and web applications. He has produced teacher training courses for using virtual learning environments, for using learning objects and so on. For some time he was also one of the coordinators of this area of ICT in Education at the institution, promoting then all training, teacher training. He has also taught courses in distance, semi-distance and distance learning.

Finally, the third respondent (R3) has a specialization in Human Rights and a master's and doctorate degrees in Developmental Disorders. For four years, she was also the coordinator of the nucleus for the rights of the elderly and the disabled, at the Public Defender's Office of the State of São Paulo. She currently coordinates a Commission for the Rights of Persons with Disabilities at the National Association of Public Defenders (ANADEP) that brings together representatives and public defenders from different states in the country. They work with the monitoring of legislative projects, elaboration of techniques by this commission. She is not currently in a specialized area for people with disabilities. She gives many lectures that we call at the Public Defender's Office of Education in Rights for People to have information about their rights. She has also done academic work, especially in relation to teaching classes in a course on the rights of people with disabilities at the CBI in Miami, which is conducted entirely online.

Results of the interviews

Next items will present the responses given to each of the 9 questions that address the implementation of ICTs in schools and other educational institutions and disadvantaged groups that need support.

ICT-based solutions that instructors and teachers apply most in their educational activities

There seem to be different views on the applications of ICT-based solutions that instructors and teachers use. Two views refer to their own use as a teacher, another to a broader view of the incipient research that has been carried out in Brazil using ICTs in Education. A third view con-

cerns how to eliminate the ICTs barriers in the education of people with disabilities.

For the first respondent (R1), the use of ICTs is strongly linked to communication channels (e-mail, WhatsApp, etc.) and also to Virtual Learning Environments (Moodle, for example).

"I actually use a lot of information and communication technologies not only email, well-known digital platforms, such as Moodle, but also the internal platforms that today our university has. It is an internal communication system, thus social, closed working groups, and even WhatsApp in small groups" (R1).

On the other hand, R2 reports that the use of ICTs in education is quite incipient, it has not happened in a massive way. It has mainly been applied in undergraduate courses, higher education, in specialization courses. However, where it has been applied, ICTs seem to improve student motivation.

"The impression I have from these means of communication that I mentioned, from conferences, etc., is that mostly ICTs, the introduction of ICTs in education has been done within the scope of distance education there mainly in undergraduate courses, higher education, in specialization courses, that is, the application of ICTs in face-to-face education, it still seems to me quite incipient and it has happened in a very widespread way and mainly in the scope of research. Really vague and widely spaced reports of experience are what we have seen. It is not something that has been done in a mass way. Anyway, the reports that we have had contact with show that where it was possible to apply ICT in education, it has shown to contribute to the motivation of students and consequently to the learning process more enriched" (R2).

Finally, the third participant (R3) brings two points on the topic. The first refers to the belief that ICT is related to distance education. The other is the need to study how to reduce technological barriers for the use of ICTs by people with disabilities.

"So my knowledge about Information and Communication Technologies is especially relevant in this area of teaching classes through these digital platforms in these online courses... In addition, my master's research and especially the doctoral research it deals with support in schools for people with autism spectrum disorders and about eliminating certain barriers that end up hindering the inclusion of people with disabilities in schools. Barriers which are related to information and communication and also technological" (R3).

"... of course there is a barrier of resources both hardware and internet infrastructure, so mainly in public schools, elementary and high schools, which also makes it difficult for these teachers to have access..." (R3).

Main barriers to the implementation of modern ICT-based solutions

According to the three respondents, the main barriers to the implementation of modern ICT solutions in Brazil come up against: lack of internet infrastructure (R1 and R2), lack of teacher training (R2) and lack of structuring of public policies (R3).

R1 says that the main difficulty in implementing an accessible digital technology project was the lack of internet in most schools in the state of Rio de Janeiro.

"... we carried out a project Technology of accessible digital technology and I understand that one of the problems faced was precisely the lack of internet in most schools" (R1).

R2 believes that the barriers are linked on two fronts: a. lack of teacher training; b. lack of resources for both hardware and internet infrastructure, especially in public schools.

"... the first of which is training. I think we have a lot of resources there, learning objects, open educational resources, but many teachers end up not having access to this, the dissemination of it, it is quite incipient and it will only happen when there is really a coordinated training of this for use in service, that is, it is not enough to just do training for example with undergraduate students but it would have to be in-service training..." (R2).

"... of course there is a barrier of resources both hardware and internet infrastructure, so on mainly in public schools, elementary and high schools, which also makes it difficult for these teachers to have access" (R2).

Finally, R3 declares that the main barriers face the lack of more assertive public policies, especially in relation to students with disabilities.

"...public policy is not specifically related to the use of information and communication technology. It does not provide clear guidelines for how this can happen... in the case of the Brazilian law of inclusion, it deals especially with assistive technologies, about the importance of using these technologies in schools it does not give a detailed description of how this

will happen. But it only talks about guaranteeing that right. It is a right that is guaranteed to the student, but does not say in what hypotheses, in what situations, for what types of students it will be provided" (R3).

Use of the country's hardware and human potential to further increase the effectiveness of ICT-supported learning

In relation to this theme, the three respondents have opinions that complement each other: creation of digital didactic material; adequate use of ICTs and hardware linked to good usage models; teacher training; creation of more specific public policies.

R1 believes that the more accentuated availability of accessible teaching material, as well as Assistive Technologies (through alternative online communication platforms) can increase the quality of Inclusive Education.

"We have developed a digital book accessible offline so that it could, in fact, be used in schools. The issue of ICTs is also very present for me in the field of Assistive Technologies that I use a lot. Today there is an alternative online communication platform, online material. We use all this in the training of teachers" (R.1).

R2 understands that it is necessary that the ICT and hardware in the classroom be linked to good use models, in addition to the training of teachers for its proper use.

"For me it is clear and certain that the proper use of ICTs in the classroom context as being another tool to support teaching and learning, has proved to be efficient even in terms of results. I understand that this inclusion of the hardware in this context, it needs to be done in a coordinated manner mainly with good usage models, that is, showing successful cases of using these resources, then merging how a given mobile application for example can be inserted in the context of a class so that students can interact, so that students can reflect on the results, on the simulations... And of course, all of this goes through training. Training, involvement of teachers in this process. Of course, it is also necessary to provide conditions for teachers to train themselves, as teachers often have a very high workload and there is not enough time left for them to train themselves and change their educational practices" (R.2).

R3 focuses on the need to formulate public policies and professional training.

"...There is a lack of human resources in the area of education. If we think about specialized human resources, the need is even greater. The

families that come to us don't even consider the technological aspects. They are still fighting for their children's right to education. We have many different realities in Brazil and I believe that the path is the formulation of public policies and professional training" (R.3).

Business sector support for learning and inclusion through the use of ICT

None of the three respondents is from the business sector or works directly with this sector. The answers of the respondents were based on their impressions and professional experiences. In general, it is possible to reflect the little integration that exists between the business and education sectors. The references made to the business sector were focused and could even be considered reductionist. They reported only isolated initiatives and very much directed to the interests of the business sector.

R1 considered not knowing about the subject. "As for the issue of ICTs in the business sector, I really have little knowledge; I have not participated in this debate". For R2, business sector initiatives are incipient and heavily conditioned on public funding and incentives. "The impression I have is that this support from the business sector in relation to the inclusion of ICTs, is quite incipient so some initiatives that occur are from public companies. In other words, sectors that are also financed by the federal, state government, so they are not initiatives that come exactly from the business sector, purely from the business sector because the business sector usually ends up doing this when it is stimulated by the public sector so that this reverts to him some discount in terms of taxes and so on. Right now, for example, I can't remember any purely business initiative for the inclusion of ICTs in education".

R3 understands the participation of the business sector as a profitable investment. Much investment in high-cost technology that is barely accessible to a large portion of the population. For R3, technological resources add value to educational institutions.

"The pandemic we are experiencing (interviews were conducted during the March 2020 COVID-19 pandemic), the interruption of classes showed how we are lacking in technological resources. Many families do not have access to the internet or devices to be able to receive education at home. At the moment many resources are being made available, but this situation is an exception. The business sector offers sophisticated resources and serves only a portion of the population. It is... a small number of schools that assume a high cost because the use of technology is valued. It adds value to the business (school)" (R3).

Innovations used in schools

Answers to this question were diverse. One respondent does not identify the use of innovation in an inclusive school environment. Another that recognizes the use of innovation in schools, but in isolation and mainly at the initiative of the teacher. Finally, one respondent that identifies many innovative initiatives in the school environment, including those that aim the inclusion of people with disabilities.

R1 identifies many proposals for innovation in the school environment, especially for students at the end of basic training. It also recognizes initiatives aimed at inclusive education. "...I see that schools, especially high schools, have been able to advance and create innovative practices. I know some of them: Teaching history using digital platforms and teaching geography using digital platforms. It has many resources and software and resources in the area of Mathematics, open, public that you can use. In my specific field of Special Education, we also have a multitude of platforms that benefit not only communication but, in fact, the participation of individuals with disabilities in various activities, whether educational or social".

For R2, although there are innovation initiatives, these occur in an isolated, uncoordinated way and often through individual or specific initiatives linked to scientific research. He understands that the teacher needs to adhere to the proposal of innovation in the school environment for the initiative to be effective. "Innovations are used in a way, from very individual initiatives. There is really no coordinated advance. In fact, this coordination exists when there is an announcement issued by the federal, state governments. ...without these initiatives, they are very punctual, especially on the initiative of a professor or because he has experience with that or because this is related to some graduate project of his own and so on. Even research carried out at master and doctoral levels, they end up having little inclusion in schools, and there is no dissemination, massification of results in schools. And this often happens due to a lack of coordination. In other words, many times teachers are not stimulated and often administrations, instead of encouraging them, they end up inhibiting this from happening. It seems to me that there is also a fear that when you put ICTs in the classroom, ...so many times you have to leave your comfort zone without having greater support for the coordinated use of this. Then it ends up being on the shelves. But it is clear that there are some actions there with the use of these tools in schools, but this is in fact not massified".

Supported by his professional experience R3 believes that maintaining innovation outside the school environment strengthens the position of

many schools that still resist inclusive education. “In my experience, I can tell you how it is not used. I deal with people who are trying to access the school. And as a justification to hinder this access, there is a lack of human resources and infrastructure, which I understand is where innovation is applied, or not”.

Support for the development of ICT-related skills among those responsible for learning and digital inclusion

Respondents believe that support for the development of ICT-related skills can be provided through training courses for teachers and, as a consequence, teachers contribute to digital inclusion in the community. The R1 points out that Ministry of Science, Technology, Innovation and Communications (MCTIC), organ of federal government whose mission is to produce knowledge, wealth for Brazil and to contribute to the quality of life of Brazilians (Brazil, 2019) has a digital inclusion project that helps people with difficulty in using technologies. This project offers courses in the area of technology and involves the academic community, mainly undergraduate students who are doing their scientific initiation. Despite involving a variety of people in the community, the elderly felt empowered when they learned to use technology. “Today I coordinate a digital inclusion project that serves, or intends to serve, it is funded by the Ministry of Science and Technology, more than 5,000 people in the community, from children to the elderly, in the area of games, introduction to robotics, applications, inclusion digital even for the elderly and people over 30 years old who have difficulty using technologies and also in the audiovisual area. It is a development project because it involves not only the extension part, offering courses, but also the science part, of Scientific Initiation, because the monitors of these courses or professors are all Scientific Initiation scholarship, because in addition to teaching classes, they also produce material in the field of technology. It is an innovative project, especially in the field for example for the elderly. Many elderly people have even changed their attitude, empowered themselves, created groups, their first email, their social network, so it has been working very well” (R1).

In R2’s perspective, teachers should learn how to use ICTs in the classroom efficiently taking into account the resources available in schools. Creativity in the use of these resources is a determining factor for digital inclusion. This respondent also points out that graduate students who are in the field of technology can help teachers to use ICTs according to their needs in the classroom. "As a researcher and teacher I understand that we must create courses, provide training so that teachers can effectively learn to use these technologies in the classroom. We must do this in a creative way considering the resources that the institutions and these teachers have at their disposal, the fact that they don’t have so much

resources, so much hardware, so much internet should not prevent this from starting in any way. Of course, all of this has to be done in coordination with school leaders so that teachers are not prevented from using it. So it seems to me that this is it, we need to create courses in service, that is, whether they are improvement courses, specialization courses, or even projects in subjects so that graduate students can go to schools and can help these teachers to introduce ICTs in their context applied to a particular course, to a certain content if not in the entire course, but to a certain topic so that they can understand how much this can contribute to the students' motivation and consequently to the learning".

R3, on the other hand, notes that there is no specific public policy for the use of ICT in schools, according to the complaints she receives from people connected to the school and other community groups, such as the elderly. She shows that the elimination of inclusion barriers is hampered by the lack of human resources for students with disabilities. "For all that I also researched during my PhD studies, I analyzed that we really do not have a specific public policy in relation to this, in relation to information and communication technologies. There was an attempt to accomplish this specifically in the area of education for the public, people, students who have a disability and who need these resources, these supports. But with the political changes that have taken place over the years in the country, in the past three years it can be said, many of the policies initiated have been deconstructed or have been discontinued or have simply been stopped and there has been no progression in relation to a continuity in this regard... But, what we see is that it does not exist, it is not a complaint that comes, because the complaint, in the end, in relation to students with disabilities it ends up prior to a discussion of an information technology, because the concern, as I mentioned, comes mainly from the lack of human resources that they, which fathers and mothers would understand as the main ones, to contribute to the elimination of this information and communication barrier that happens in schools. In other words, the placement of an auxiliary teacher, from specialized accompaniment, is looked at much more from this perspective".

Methods and strategies that we must adopt to develop open educational resources in Brazil

Respondents point out a prior identification of deficiencies in Education and the development of materials in academic research groups as methods and strategies for the development of open educational resources in Brazil. For one respondent, the government support is important to leverage the infrastructure and training of teachers and students.

For R2, the development of open educational resources should be based on universal design to consider the inclusion and based on participatory design that involves users both in the development of this material and in its evaluation. The pedagogical strategies and the teaching-learning needs of each course are decisive in the production of didactic material in the form of open educational resources. In this sense, R2 highlights two paths to be followed. "Well, I think there are two paths out there. One way is to identify shortcomings, needs, that is, making contact with teachers, identifying where the greatest shortcomings are, of course, these shortcomings are also described in many studies out there. The common national curriculum base can be a starting point too, so that we can already work with these teachers in the classroom context within their main need. Another way is once we have know-how on a certain topic, on a certain course, on a certain type of technology, which we can identify where it is possible to apply this. That would be another way. I don't start from the problem, but I start from the solution and I apply the solution. Anyway, I think that all this has to be done using methods and strategies that consider the pedagogical didactic issue, the participation of these users both in the development and in the evaluation so that they are not just involved in this when using the tool because it can be that the tool is not entirely adequate to the needs. Within this context, participatory design is extremely important. And, of course, also consider the issue of inclusion from a universal design when possible".

Universities have included in their research the development of open technologies. According to R1, research teams composed of undergraduate students in different areas of knowledge are involved in an innovative project developing digital didactic materials. "Now, all this is only possible because there is a research team, a team producing the material being used, which is the same team that coordinates the fellows, and an articulation, a public-public partnership, that is, a university locally with public management of the municipality in the area of science and technology. So, it is innovative, in this sense, and also innovative because it involves not only the community of different territories, but also more than 130 Scientific Initiation Scholarships in different areas of knowledge that are building not only software but didactic material on the use of existing platforms".

In addition, to develop open educational resources in Brazil, R3 points out "that government investment is necessary in order to provide infrastructure and training resources and mainly public policies".

Using open educational resources to collaborate with the disadvantaged groups, for example, immigrants, the unemployed, people with disabilities, and the elderly

Regarding the use of open resources for specific groups R1 points out a very delicate problem about a commonsense that is, in fact, a myth: the idea of digital natives, which has the supposition that millennial or Z-Generation people could be meant to have access to technologies and Internet, and they would be automatically connected to the digital facilities. The work of Kirschner and De Bruyckere (2017) provide enough evidence to the contrary, and R1 coincides with them. Besides, the low-level socio economic situations are conditions to the access to ICT.

"I see that this fallacy that the idea of digital natives, everyone has access to cell phones, to computers is not quite like that. This project has shown that a significant part of the periphery does not even have access to the internet. Many do not know how to use any type of digital platform, nor WhatsApp, especially the elderly" (R1).

On the other hand, R2 refers to the importance of OER (Open Educational Resources) - embracing all educational materials available in public domain, published under an open license, according to Atkins, Brown, and Hammond (2007) definition, stressed by UNESCO (2012).

"It is important to develop open educational resources that are possible for those with disabilities to use. So the question of doing development involving these people is extremely important" (R2).

OERs could play an important role by proving high-quality content, whose open licensing could allow the adaptation for specific groups and needs - even more complex content, like digital educational games, could be delivered as OER, according to Silveira and Villalba-Condori (2018).

Regarding those groups with higher degrees of social vulnerability due to economic aspects, OER could be also helpful, as shown in scientific literature that depict similar scenarios in underdeveloped and developing regions like Africa (Butcher et al., 2011) or India (Dutta, 2016). The second respondent highlights that, for these specific groups, the access to ICT could increase their networks of contacts and thus the potential to work and study.

"The question of other groups of disadvantaged groups such as immigrants, the unemployed, the elderly, also the question of digital inclusion, that is, for example in relation to the elderly who often have greater difficulty in this stage of life in learning. So these resources need to be easy

to use and of course there must be actions that reach these groups of people as well. Of course, in relation to immigrants, the unemployed, it is also important to identify tools that can even help them out of their conditions of difficulty, increase employability, and put them in a network of contacts. May technologies help to expand contact networks and knowledge so that they can be included and feel part of it too" (R2).

The social role of universities was also mentioned by R2, who mentioned the importance of joint actions, including governmental actions, which must be carried on.

"In the scope of education, this involves community projects that really involve all these audiences and that these projects are able to reach them. And also taking the solutions to public managers so that they can also help to identify the ways in which this can be disseminated, including opening spaces for these results from education, from educational institutions to reach society" (R2).

The third respondent (R3) cited some advances regarding the use of certain technologies for specific groups, like ICTs that are based in LIBRAS (as per its Spanish acronym) - the Brazilian Sign Language for the Hearing Impaired.

"...this has advanced a lot with regard to people with some hearing loss, especially to deaf people, because deaf people use sign language and they communicate a lot through cell phones by video call using these signs. And this has been used, including this information and communication technology, in relation to the city hall here in São Paulo and we have an experience in this regard, and which I followed in some way, is to conduct videoconferencing for video conference calls to providing assistance to deaf people with the use of a sign language interpreter, allowing the deaf to communicate effectively. So, this is something that really... this has been effective" (R3).

Local initiatives have been detailed by the third respondent (R3), who mentioned efforts of the São Paulo municipality in supporting hearing impaired people. "...The Municipality of São Paulo has an extremely interesting program in this sense, because they have a central for sign language support; this central performs face-to-face meetings but ... most of their calls are via video conferencing and directly dependent on these information and communication technologies".

"...this has allowed them to open posts in various public services, as in the defense department itself, and I had the opportunity to participate in this installation. This service, one of the first service stations performed,

installed by the City of São Paulo and we also have is ... from what I have been following in the news from the City of São Paulo, this is being installed in several other places, including hospitals and others services to guarantee the access of the deaf community to the necessary services through the language they are able to communicate is LIBRAS, right" (R3).

Lack of public Internet access points is a problem that was pointed out by this respondent, which would be an important factor that would prevent people, especially the elderly, from gaining access to the Internet.

For R3 "Regarding the elderly, we have this issue of a complaint related to the lack of availability of public internet so that they could make use of applications that would allow them to have access to services due to the computerization of services and the entrance doors of these services to be from using an application or a website. So the lack of the internet ends up harming and generating a loss for access".

Finally, this respondent (R3) made some connections with the 2020 COVID-19 pandemic and all subsequent strategies for schools and universities to keep providing learning opportunities, but online, and the search for up-to-date, reliable information.

"...so there was this search and I think that at the moment that we are living in relation to this pandemic of COVID, this issue will become a very crucial issue at this time, because schools, mainly of education, even of kindergarten, but of Basic and High school are having to make use of it, and universities are having to make use of these technology formats with the distance learning of children, precisely to preserve their health, and of everyone at that moment, and this has been a challenge. I can even see it from my daughter's school and from what I saw in the statement of the secretary of education when the decision to close the schools, both of the secretary of Municipal and State Education here in the State of São Paulo, in which they mentioned that they made classes available through the use of technology and that they would seek alternatives to guarantee Internet so that students who do not have Internet have access to the content that would come through technology" (R3).

The overall impact of technology in society is very clear in the speech of the third interviewee (R3), as could be noted in the following statement:

"So I think that, even in this moment that we live, information and communication technology, it is a very central issue to be discussed and to be thought about and even to see how it matters, right, how this arises in situations in which, in the past, no one would think of elementary edu-

cation, especially in the early years or even in early childhood education, the possibility of using distance learning for students through information and communication technology as well" (R3).

Support from government agencies for the use of ICT in learning and inclusion

All respondents coincide in pointing out the insufficient of governmental support for learning and inclusion through ICT. The depth, breadth and reach of governmental projects is criticized, in different levels and different perspectives, by all of them. Tomczyk and Sunday (2019) present a detailed overview of different countries in Europe, Latin America and Caribbean which shows that, despite many governmental initiatives that were taken in place in the last years, these seem not to address all problems that underdeveloped and developing countries have.

R1 said: "I think we are very poorly invested, although this project that I coordinate is a project of the Ministry of Science and Technology, but we do not have, in fact, significant investment in research, in science and in the development of these technological resources, on the contrary, any project that involves for example, the area of Humanities and Technologies is still little valued in our country, unlike other countries".

In the vision of this respondent, the low compromise of government with poorly-funded projects make teachers and researchers feel unmotivated to invest their time and efforts in endeavors that are not well-valued by the government nor the community.

The second respondent (R2) has a little more optimistic view about some advances perceived in the past few years in Brazil regarding ICT in education and inclusion.

"So there have been, if not in sufficient quantity, but there have been public notices from government agencies, state research support foundations, and so on, specific notices have been issued for ICT in learning. And some of them are also related to inclusion and there have been projects, notices that end up encouraging products for inclusion, mainly of disabled people" (R2).

Many of the aspects raised by the respondent could be associated with the recent governmental budget cuts, which constantly and consistently has been promoting an expressive reduction on the already insufficient budget destined to Education and Technology, especially after 2016. He also highlights the necessity of keeping all results of investments in public domain, as already defended by Kelly (2019).

"...of course, this is still insufficient to serve a range of people, but this has in fact happened. One of the premises that have appeared in these notices is that these results must be kept in public repositories. Then we end up going back to what was put on other issues. How can this be used? It is worthless just putting this in the repositories but there must be training, dissemination and application actions in the classroom, in service so that these resources are not only on the shelves of digital repositories" (R2).

R3 put more emphasis on the effectiveness of the governmental initiatives - in her view, many of the efforts dispensed by governmental actions did not reach the classroom, nor does the government have mechanisms to measure the efficacy of its actions.

"...the public authorities recognize the importance and the right to use technologies in the student's learning environment, and have recognized this right, but there is little movement to ensure that the use actually occurs" (R2).

This important gap between government's decisions and initiatives and the real, down-to-earth impact on schools is also mentioned by this respondent, which affirms that "...there is a lack of investment for educational institutions and the availability of free resources that allow access to all who need it. I see movements and actions for access to the internet and more general infrastructure. And yet these resources are often not made available in the classroom".

Discussion

About ICT-based solutions used in the educational activities, in Brazil, according to Amiel and Oliveira (2018), it is necessary to extend the use of Virtual Learning Environment (VLEs) to broader context. The VLEs can be used to connect students and teachers and active teaching-learning methodologies. Digital platforms can promote experiences that have the potential to improve the teaching-learning process in the school context.

Although respondents R1 and R2 mentioned VLEs, it cannot be said whether they have a belief in how much digital platforms can influence the teaching-learning process.

In Brazil, the lack of investments has been felt in the lack of structure in public schools, in the lack of digital literacy for teachers and in the lack of research in the area (Amato et al., 2019).

However, some government actions can be highlighted (Brazil, 2017a), (Lavinas & Veigas, 2013), (Brazil, 2017b), (Brazil, 2018a), (Brazil, 2018b), as well as actions resulting from the approximation of the university and the community (Maciel, Bim, & Figueiredo, 2018), (Pletsch & Souza, 2017), (Martins et al., 2019), (França & Tedesco, 2015), (Souza & Mombach, 2016), (Rodrigues et al., 2019), (Martins & Eloy, 2019).

The reports brought by the approach of the university and the community are pointed out by respondent R3 as promising to improve students' motivation and also to act positively in the teaching-learning process. However, it raises the question of still being insufficient and incipient.

In Table 1, there are the main aspects discussed here.

Table 1. Main points about ICT-based solutions used in the educational activities

• Virtual environments are being used mainly in undergraduate courses, higher education, in specialization courses.
• Lack of governmental investment.
• Lack of digital literacy on the part of teachers.
• Brazil doesn't have massive use in ICT in education.
• Brazil has incipient research in ICT in education.

According to Amato et al. (2019), there are several factors that contribute to the problem of implementing ICTs in schools in Brazil, among which it is possible to mention the lack of government investment in public schools, which leads to the lack of school infrastructure, the lack of digital literacy of teachers in addition to the teachers' workload.

These issues are corroborated by R1 and R2; however, R3 raises a very important problem that is related to the lack of more well-defined public policies. Table 2 presents the main aspects discussed about this theme.

Table 2. Main barriers to the implementation of modern ICT-based solutions

- Lack of governmental investment.
- Lack of digital literacy on the part of teachers.
- Lack of school infrastructure.
- Lack of more defined public policies.

According to Albino and Souza (2016), the promotion of human development necessarily involves the provision of quality education, accessible to all and committed to the demands of the current world. ICTs have been identified as allies in the teaching-learning process and would improve their quality.

However, just increasing the number of computers and other computer equipment has little impact on student performance or even a negative impact. ICTs must act in a complementary way to teaching, with ICTs not being able to replace the traditional method (Firpo & De Pieri, 2012).

R2 corroborates this view by presenting the need to use ICTs and hardware through good usage models.

According to Leite and Ribeiro (2012), for the inclusion of ICTs in a positive way, it is necessary to unite several factors, among which stand out: the teacher's mastery over existing technologies and their use in practice; that the school has a good physical and material structure, which allows the use of these technologies during classes; that governments invest in training, so that teachers can update themselves in the face of changes and technological advances; that the teacher remains motivated to learn and innovate in his pedagogical practice; that school curricula can integrate the use of new technologies into the content blocks of the various courses.

These questions are addressed by the three respondents in a complementary manner: need for good physical structure, accessible teaching materials, and training.

The way in which the educational system incorporates ICTs directly affects the reduction of the digital divide that exists in the country. Thus, for the purpose of public policy decisions, an analysis of the effective use of ICTs in schools is necessary through an overview of the skills and knowledge of students and teachers

The concern with the digital exclusion goes through the responses of R1 and R3, in addition to the question of public policies indicated by R3. Table 3 presents the main aspects discussed about this theme.

Table 3. Main aspects of using of the country's hardware and human potential to further increase the effectiveness of ICT-supported learning

• Creation of digital didactic material.
• Adequate use of ICTs and hardware linked to good usage models.
• Teacher training.
• Creation of more specific public policies.

Although none of the respondents is from the business sector, their perceptions are the same as those in the business sector in many ways. According to the mapping on educational technology carried out by the Brazilian Association of Startups and the Innovation Center for Brazilian Education (Abstartup & CIEB, 2018) entrepreneurs emphasize the lack of physical structure in schools, the need to broaden the understanding of technology on the part of education professionals. Lack of training for teachers as also mentioned by R2. In addition to highlighting the bureaucracy as an obstacle and recognizing that the government must address the demands as mentioned by R2 and R3.

It is worth mentioning that the mapping points to great interest by the business sector in investing in the area of education with significant growth in the number of companies operating in the sector. In this perspective, it is possible to expect greater integration between the business and educational sectors, making the presence of the business sector in educational environments more visible. This will make it possible for education professionals like R1, even far from the business sector, to comment on the benefits of the company-education partnership in the teaching-learning context.

Table 4. Main aspects of the relationship between the business sector and learning and inclusion through the use of ICT

- Lack of professional training.
- Lack of integration between business and education sectors.
- Fledgling investment, personal initiatives.
- Investment linked to government incentives and benefits.
- High financial cost.

This question had three different answers and related expertise of each of the respondents. R1's answer brings his experience to the area of education, classroom, pedagogical practices and strategies aimed at inclusion. It mentions a series of innovative initiatives and it can be said that it attaches importance to them in the learning path. Highlights that diversified options for different objectives. This perception is reinforced by several studies, Leite and Ribeiro (2012), Sousa (2016) and Amato et al. (2019) that point to the growth of innovations aimed at the Brazilian educational context.

R2, has his career in technology and has a more focused awareness to the educational system as a whole. It highlights difficulties in the process of introducing innovations in the school context, such as the lack of training and adherence of professionals. For R2, innovation needs to be appropriate by the education system, and must be present within the system as routine and not just as a timely initiative. As also recognized Albino and Souza (2016) only when innovation is part of the routine of schools in a mass form it will have all possible use. The third perspective, from R3, is based on who works with the dynamics of exclusion, of the struggle to guarantee fundamental rights. In this routine where the fight is still to guarantee the right to education, there is no room for innovation because innovation would be a possible path to inclusion. Many educational institutions still do not respect the right to education in a regular school for all as quoted by Conte et al. (2017).

Table 5. Main aspects of how innovations are used in schools

Positive aspects:

- Diversified innovative practices.
- Innovations with free access.
- Diversity of innovations focused on inclusion.

Negative aspects:

- Lack of professional training.
- Teacher's resistance to the use of innovation in the classroom.
- Use of innovation as a personal initiative or linked to research.
- Innovation does not occur massively at school.
- Refusal of innovation at school in order not to favor school inclusion.

Regarding the aspects of support for the development of skills related to ICT among those responsible for learning and digital inclusion, there are some government programs with projects in this direction, such as ProInfo - National Program for Continuing Education in Educational Technology (Brasil, 2018c) and Teachers' Portal, a virtual environment with educational resources that facilitate and motivate the work and a space for exchange of experiences between elementary and middle school teachers (Brasil, 2018a). In this context, R1 presents a project funded by the Ministry of Science, Technology, Innovation and Communications (MCTIC), where undergraduate students can teach courses and also produce materials in the field of technology.

R1 and R2 agree that it is necessary to train teachers in the use of technology so that they can use them as didactic support in their classes. But, in the context of primary and high school education, teachers have great difficulty in adapting their teaching strategies to the new technological reality, for reasons such as work overload, lack of proper training, lack of technical support in schools, among others (Silva & Castro-Filho, 2017).

R2 also highlights that training courses for teachers must be creative to compensate for the few resources that institutions have, especially

public institutions, in addition to encouraging them in the use of technology.

Faced with the use of technologies, R3 warns of the lack of human resources to help eliminate information and communication barriers in schools, especially in relation to students with disabilities. The inclusion of an auxiliary teacher who monitors the students' difficulties could minimize these barriers. Table 6 shows the essential aspects discussed by the respondents about supporting development of ICT-related skills among people responsible for learning and digital inclusion.

Table 6. Main aspects of supporting development of ICT-related skills among people responsible for learning and digital inclusion

- Training courses for teachers.
- Use of ICT with creativity.
- Lack of human resources for students with disabilities.

The involvement of stakeholders during the development process of open educational resources, through Participatory Design can guarantee the efficiency of its use in the teaching-learning process (Melo, Saldanha, & Wernz, 2012), because Participatory Design involves the active participation of stakeholders during the software or educational resource development process (Simonsen & Robertson, 2010). With the participation of teachers and students, in this process, the criteria and requirements necessary for an educational software will be precisely determined (Matos, 2013).

In addition, the development of open educational resources must consider Universal Design to be able to serve its diverse audiences, respecting cultural, social, cognitive differences, among others, which are subjective to humans (Rosa & Matos, 2016). To identify the shortages and needs for the use of ICT in the various disciplines, R2 and Alves, Rosa and Matos (2018) suggests the use of Participatory Design as an important element to ensure the implementation of pedagogical methods and strategies. In this context, R1 highlights the participation of professors and undergraduate students from various areas of knowledge in the production of digital teaching materials.

R2 also highlights the importance of Universal Design to ensure the inclusion and participation of all students, respectively. This care in the process of developing open educational resources will facilitate the use of the tool and its adaptation to pedagogical needs.

In order to achieve the development of open educational resources in Brazil, R1 points out the role of Universities allied to government investments to ensure the promotion of research in the area of digital inclusion and the development of educational software. Complementing this issue, R3 recalls the importance of government investments to provide resources not only for infrastructure (such as the installation of computer labs, Internet access in public schools, among others), but also for the training of teachers in the use of these technologies to adequately support the teaching-learning process. Table 7 summarizes the respondents' notes on issues related to the development of open educational resources in Brazil.

Table 7. Main aspects of developing open educational resources in Brazil

- Participatory Design.
- Universal Design.
- Participation of universities in the development of open technologies.
- Government investment.

The three respondents had different approaches for the question related to the methods and strategies that must be adopted to develop OER in Brazil. One of them (R1) stressed out the point that public policies could not assume that people (especially young people) would have "natural" access to technology. Thus, the myth of "digital natives" should be confronted as suggested by Kirschner and De Bruyckere (2017). The same respondent highlighted the fact that the socio-economic aspect is determinant to define the access to ICT.

On the other hand, the second respondent (R2) identified that the open licenses that are straightforwardly associated to OER are the key for adapting already existent educational resources to specific needs, addressing them to the requirements and expectancies of specific groups, as was already defended by Silveira (2016). He also stated that the access to technology is an important and facilitating factor that would allow disadvantaged people to establish networks that would facilitate the access to work or learning.

The third respondent brought an interesting scenario about her experience with a local municipality initiative focused on the hearing impaired, that managed the use of ICT artifacts to provide LIBRAS-based services to this population. Some connections with the crisis of COVID-19 pandemic, which pushed instructors from all around the world to move to

distance learning were also established by R3, since this movement was perceived including the basic levels of formal education, and few or no concern about inclusion was made by educational actors.

Table 8. Main aspects of open educational resources to collaborate with the disadvantaged groups

- There are no "digital natives" nor could the universal access to technology could be pre-assumed.
- Possibilities of adaptation of OER to specific needs guaranteed by open licenses.
- Reality shows that the reach of digital resources is not comprehensive in Brazil.
- Technology could help disadvantaged people to establish new connections and have opportunities of working and learning.

About the support given by government agencies to the use of ICTs in Learning and Inclusion, all respondents were unanimous to point out the insufficiency of the governmental actions and initiatives. If they exist, they are not enough to fulfill all expectancies and needs of an extremely unequal country, which presents different realities in different contexts.

There are some local initiatives, as mentioned by R3 regarding the effort of the municipality of São Paulo - the biggest city in the country - to support the hearing impaired. This kind of locally-based actions sounds more effective, since these instances of governmental power are closer to the citizens' realities and needs, being more able to properly reach the expectations of the local population.

The importance of governmental efforts to have impact on people is highlighted by all respondents, more strongly by R1 and R2. This last one affirms that the governmental educational initiatives could be with no use if they don't reach students and teachers. Thus, some follow-up strategies must be drawn to ensure the efficacy of these initiatives - as defended by Kelly (2019).

Table 9. Main aspects about how government agencies support the use of ICTs in Learning and Inclusion

• There is an insufficient government support for learning and inclusion through ICT.
• Government-funding initiatives for leveraging Inclusion and Education must be followed-up to guarantee that they would reach the target public.
• Some local (municipality and state-funded) initiatives are important since these levels of government are closer to the citizens.

The interviews brought a limited but important set of opinions and reports about the main aspects of leveraging Education and Inclusion in a big and diverse country like Brazil. Even though the chosen approach does not bring new quantitative data nor new categories for qualitative data analysis, it allows the establishment of a discussion basis, given three different points of view of experts in their fields, which made possible to draw a scenario of the diverse realities, challenges, actions and initiatives related to Education and Inclusion in this country.

Further works point out in the direction of having more respondents from different backgrounds in order to achieve a wider panorama of Brazilian reality. A deeper cross-analysis with quantitative and qualitative data regarding to Education and Inclusion in Brazil is also needed to better understand the realities, expectations and needs of such a challenging society.

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