ICT and education in the perspective of experts from business, government, academia and NGOs

In Europe, Latin America and Caribbean

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Tabla de contenido

Introduction

The real power of interactive technologies is that they let us learn in ways that aren't otherwise possible or practical.

David Lassner

With the passing of the years, Information and communication technology (ICT) has acquired a place in society. Information and communication technology has become an integral part of our lives. They have shaped many of the activities we carry out day by day, such as the way we communicate, the way we read, the way we see the world and, of course, the way we learn.

These changes have transformed the belief that education is a personal aspect that concerns only teachers and students. Information, communication technology is promising a huge opportunity for both teachers and learners to give and gain equality. With the demographic changes that the whole world is facing, countries face the need to handle the provision of education to the whole population especially to minority and disadvantaged groups. This right truly represents a social challenge that should be reflected in diverse attempts to identify, analyze and further work to eliminate barriers.

We could say technological tools are granting an outmost opportunity to reach all students in classes, to make lessons interesting, interactive and diverse, but most importantly, ICT is promising a unique opportunity to fulfill the right to education to the entire population. Many countries around the world are developing different ICT policies, mainly aimed at special education and education to minority groups. In this regard, many aspects such as context, teacher education on ICT, policies, resources and access are crucial when efforts are given to include technology in classrooms.

The heavy responsibility that this means to teachers, parents, students, government and society in general is immense. Adapting teaching for all students and making education accessible to all groups is a complex task. Thus, it is necessary to look into the perceptions that specialists have on the issue of including ICT to education. Digging into these perceptions will clarify ideas and guide future research on how countries should invest on technology, teacher training and the creation of policies.

We are handing over to our readers a book that is deeply rooted in two leading paradigms for media pedagogy. One of them points to the opportunities that ICT brings to education and training. The second is

related to the threats, challenges and limitations in selected countries in Latin America, the Caribbean and Europe. The interpenetration of both paradigms, i.e. opportunities and threats, is visible in the narratives of experts who see both light and dark sides of the implementation of new media in education.

The overall aim of the book is to obtain the opinion of experts and actors that are involved in the provision of support to people with certain disabilities. The following actors and experts were consulted in the study: social workers, ICT experts, business experts, teachers with expertise in social and migrant issues. The study data collected has helped in the mapping of the issue at hand from four different viewpoints, including education, technical, business and non-governmental sectors.

Given the complexity of the study as a multicontinental and multifaceted project, the researchers agreed on the use of a qualitative research method. An expert interview technique was used to collect rich and thoughtful opinion data from the four complimentary sectors. Most of the interviewees are well-known experts, who have accrued several years of working experience in either developing ICT-based solutions for education, implementing decision as top-level executive in the business sector or involved in providing care for the people with disabilities. The interpretative paradigm grounded was used to analyze the participants' responses regarding the roles played by ICT in supporting inclusive education. Furthermore, the analysis was undertaken to understand the roles played by the experts in bridging the interplay between education and ICT and to know about the impact of ICT in learning and inclusion processes.

Each chapter explores the reality of the different countries and provides insights about the kinds of ICT tools used in current education settings. These notions of technology in terms of hardware, software, and communications have varied priority levels in the different counterparts. However, recurrent topics include digital divide, digital literacy, and their implications in teachers' appropriation of technology, which effectiveness in technology integration could be tied to teacher involvement. The range of solutions includes the use of proprietary and open source learning environments. Thus, the use of commercial solutions could hinder some population segments from accessing materials. Open sourced projects like the Smart Ecosystem for Learning and Inclusion Platform (SELI learning platform, https://seli.uazuay.edu.ec/) are a need! In any case, it is possible that innovation resides in what people do as they appropriate technology and not in technology itself.

This book is written in line with the overall goal of the SELI project, which aims at training no less than 50 pre-service and in-service teachers

in each partner country on ICT skills, and at least 100 students, who need inclusion in education. Under this paramount inclusive term, we include the elderly, unemployed, migrants, disabled, homeless, and people living in remote or poorer areas, from each partner country. The trainings have been developed through the SELI platform, which is the pillar of this whole project.

Magali Arteaga, Lukasz Tomczyk, Gabriel Barros & Solomon S. Oyelere

For SELI Team

Qualitative research methodology

Lukasz Tomczyk

Methods

Research problems

The research objective was to show the conditions of ICT implementation in education and non-formal education sectors. The study was also aimed at presenting the specifics of digital inclusion and organizational-administrative aspects of full and sustainable use of ICT in the information society. Given such research problems, the technique of qualitative interview was used. The following research problems were identified:

- What ICT-based solutions are most frequently and most effectively used by trainers and teachers in Europe, Latin America and Caribbean?

- What is the greatest obstacle to introduction of the ICT-based solutions in Europe, Latin America and Caribbean?

- How can we use technical and human potential in Europe, Latin America and Caribbean to further increase the effectiveness of ICT-supported education?

- How does the business sector support ICT-based learning and integration?

- Which Europe, Latin America and Caribbean innovations can be considered significant?

Another group of the research problems oscillated around the issue of digital inclusion and digital literacy development, with particular focus on the groups in need of educational and organizational support. The detailed research objectives for this group of questions were formulated as follows:

- How should we support the development of ICT-related skills among the people who are responsible for learning and integration process (trainers and teachers)?

- What methods and which strategy should we adopt to develop education resources in Europe, Latin America and Caribbean?

- How should we use open education resources to collaborate with disfavoured groups, e.g. immigrants, the unemployed, the disabled, seniors?

- How do governmental agencies support the use of ICT in learning and social integration in Europe, Latin America and Caribbean?

Methods, techniques and tools

Given the research problems listed above, the qualitative method, expert interview technique and a structured interview questionnaire were used (Stempień & Rostocki, 2013). Based on the problems presented in the previous section, the research tool was designed accordingly. The questionnaire was subject to a double internal review performed by the expert involved in the project SELI - Smart Ecosystem for Learning and Inclusion - ERANet17/ICT-0076. The reference research tool which was translated into local languages was the English document. The tool was used in the comparative studies in the selected countries of Latin America, Caribbean (Dominican Republic) and European (Finland, Turkey, Poland). It was used to collect data directly (face to face meetings) and via different channels, for example through phone or online communicators. Mediated communication with the experts resulted from the availability of those experts.

Data analysis techniques

For data analysis, the standard procedure of qualitative data processing was used. Transcriptions of the interviews were coded, that is, the answers were classified, or categorized, according to the search system set in the research problems. The examples of certain codes (defined through variables) were cited and then interpreted according to the knowledge of the persons analyzing the texts. The codes (answer categories) organize the respondents' statements. In the final section of the analysis, the conclusions drawn from the expert statements were analyzed in the light of the research problems and then the synthesis was made using info graphics, concept maps or tables (Babbie, 2015). Thus, the research procedure was the following:

- Development of a common position regarding the research problems (reduction of the research problems and linguistic verification - adaptation of the research areas to national conditions of SELI participants);

- Translation of tools into local languages (Spanish, Portuguese, Polish, Turkish);

- Selection of experts to be interviewed using stratification of professional activities of the respondents (adoption of different perspectives: education, NGO and business sector);

- Conducting direct or ICT-mediated interviews;

- Transcription of interviews;

- Coding, categorisation and interpretation;

- Summary of results in infographics, concept maps and tables, and development of postulates for teaching practice and comparative studies.

Data analysis was conducted within the interpretative paradigm of qualitative research. This assumption enables subjective view on the education-related processes and the motives which accompany learning, teaching, inclusion and organization of educational activities. The interpretative paradigm is the opposite of the quantitative data collection methods, as it is based on a subjective point of view. This subjective point of view is particularly noticeable in our research in the opinions of the representatives of three different sectors, who share one common feature defined in the research problems. Studies of this type highlight individual experiences which are unique and at the same time mediated through the professional environment of the respondents. The interpretative approach is used in the small-scale research, shows the micro worlds of the respondents and is highly subjective. Research within this paradigm require personal engagement from the researchers (e.g. similar professional experiences). Interpretation of the details found in the respondents' narratives is the result of the experience of the persons who designed and conducted the interviews. Thus, the research is set in the pedagogical phenomenology (Cohen, Manion & Morrison, 2002; Łuszczuk, 2008).

Ethics

The study was fully compliant with the ethics of pedagogical research. Every respondent was informed about the goal of the research and possible resignation from the interview or removal of parts of their statements. The interviewers obtained the respondents' consent to archive the interviews in audio format. Interview description was done in a way to ensure the anonymity of the respondents. Due to the evaluating character of the statements about social activities and certain institutions, and to protect the respondents from being recognized, data allowing to identify the interviewees were deleted from the sample characteristics section.

ICT in schools and intercultural education in Bolivia. Challenges of digital inclusion

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Abstract

This document attempts to get the challenges and opportunities in the use of ICT and inclusion in the educational process in Bolivia. The analysis is the application of a structured questionnaire to interview under qualitative research. The interview collects perceptions and perspectives from two teachers, who work with ICT and inclusion in the education field. The interviewees have long experience introducing ICT in education. The results can aim in the reflection and contrast the evolution of ICT in education towards improvements by interested stakeholders.

Keywords: digital inclusion, digital literacy, special education, postgraduate education, information society.

1. Introduction

Information and Communication Technologies (ICT) in recent decades have become relevant in all areas; especially in how they can support various activities like educational activities. Education is going to take advantage of increasing generational skills with technology.

In Bolivia, since the 1960s, the educational reforms recognize the different educational areas, including explicitly special education. The United Nations Educational Scientific and Cultural Organization (UNESCO) on its report (UNESCO, 2010) refers to the education reform enacted 1994 in law 1565, where establishes the democratic character of education since the whole of society participates in its planning, organization, execution and evaluation. The report (UNESCO, 2010) also refers to the incorporation of the intercultural approach and the bilingual modality in education, responding to the socio-cultural heterogeneity of the country. In the 1990s, most governments start the inclusion in their Constitutions the need to become aware of and take action on inclusive education. In the global context, Bolivia explicitly includes regulations on special education and the need to create a portfolio specifically dedicated to the issues for this type of training (Estado Plurinacional de Bolivia, 2010). Inclusive education is part of the rules, giving the possibility to disadvantaged students participate in the regular education classroom.

The use and exploitation of ICT in the educational task is a central axis. It is under the responsibility of action by the Ministry of Education and its vice ministries. It is a proposal since the 2010 educational reform.

With this legal framework, the spirit of this study is to collect the experiences of people involved in the teaching-learning process with ICT in regular, special and intercultural-indigenous education. The findings help to understand the real situation of ICT and education in Bolivia, the consistency of this reality with the regulations, the adequate support of the entities involved in education; such as government, teachers, students, industry, and others.

2. Methodology and characteristics of the Bolivian sample

The Qualitative research approach is used in the study. The data is collected with interviews using a structured questionnaire with open questions about general information (professional experience, the field of work, teaching/administrative position), implementation of ICT in educational institutions, and feedback about support development of educational ICT in favor of disadvantaged people. The interviews were conducted in a personal face-to-face meeting in a comfortable place se-

lected by the interviewee. All the interviews were audio-recorded with the consent of the interviewee. The interview duration was between 36 and 60 minutes. Finally, the data were analyzed using the interpretative paradigm.

The data researchers gathered in late-2019 through personal interview. Two professionals in the Bolivian city of Cochabamba answered the questions with the purpose to identify the challenges and opportunities in the use of ICT and inclusion in the educational process in Bolivia. The selection of the interviewees followed three qualifications: long time working with ICT in education, experience in the use of ICT with disadvantaged people, and participation in pre-service teacher or intercultural people training.

The first interviewee is a researcher professor working since 1996 in the Training Program in Intercultural Bilingual Education for the Andean Countries from the Universidad Mayor de San Simón (PROEIB[1]). The main activity of the interviewee is oriented to postgraduate training and research emphasizing intercultural-indigenous education (Interviewee 1).

The second interviewee is a teacher with more than ten years of experience in special education. He is currently teaching to pre-service teachers at the "Escuela Superior de Formación de Maestros Simón Rodríguez (ESFM Simón Rodríguez)". He has worked for seven years as a full professor in the special education field and has been director of a center for special education in for two years. The interviewee work focuses on special education and activities that allow educational inclusion (Interviewee 2).

3. Results

In the following sections, we present the results of analysis following eight criteria:

1) ICT use for inclusion in education

2) Obstacles to the introduction of modern ICT-based solutions in Bolivia

3) Hardware and human potential and ICT-mediated education

4) The role of business in the educational sector

[1] http: //www.proeibandes.org/

5) ICT and educational innovations in Bolivia

6) Support the development of ICT-related skills among people responsible for learning and digital inclusion

7) Open educational resources and work with disadvantaged groups

8) Support the use of ICT in learning and social integration in Bolivia in light of government actions

These eight criteria will help to identify challenges and opportunities for Bolivia in the use of ICT in education.

3.1 ICT use for inclusion in education

The first interviewee mentions experiences of inclusion of ICT in postgraduate training, to facilitate the study of doctoral and master students under the intercultural framework.

The incorporation of ICT is an alternative to facilitate the study of doctoral students or teachers in blended training plans using Moodle (a well-known platform in the institution). The platform is an accessible space for students and teachers from anywhere across the Internet. Educational activities involve many tools and resources like search engines, emails, forums, virtual conferences.

The interviewee refers to this experience as successful and rescues how the different actors relate in the educational process is long overdue. The experience shows how the need to have the students of this study program connected during the development of distance courses.

"The experience helped us to add the use of technologies in a more improved perspective. In the Intercultural Education Specialization course, the design was an indigenous chair that was face-to-face. This experience had one of the indigenous leaders as a teacher, together with a university teacher. The courses took nine months; one month face-to-face and the rest of months were all mediated by Internet access by computers. ... In our case, due to international circumstances and availability to the students, we adopted Moodle... The Moodle platform was the most appropriate selected to use in the course" (Interviewee 1).

"Although evidently, the idea was that all the strategies and pedagogical design have that (open) character; because our impact of the Specialty in Intercultural Education fell to both students, non-students like leaders of the indigenous people, leaders of organizations; let's say by rebound,

but the interesting thing about that effect is that the curriculum itself, in this case, forms a kind of community of interests" (Interviewee 1).

A fundamental element in the use of ICT tools in education is the design of educational materials with the strategies and activities that the student should develop. The plan of evaluation by cross-learning lets to students work without neglect; since their performance depended on others and in turn, influenced others. The educational process must take into account the culture and the essence of students and in the content and usage approach of tools. In the program study, from the experience of the interviewee, the teachers were indigenous leaders. They came from different places and universities giving face-to-face class during a determined time, and the rest of the course in virtual mode. The intercultural education having the participation of leaders of peoples, stands the principle of being a community with the same interests helps to perform well the course. The pedagogical strategy based on the principle of being a community of interests and leaders' participation are factors of success. But other aspects like the content of the study program, the teachers, and the blended context has importance and let themselves to use these tools and technologies successfully. In the experience of the first interviewee, the critical factors determining the successful use of ICT are the cultural trait, the knowledge of ICT by the people involved, the need of using ICT, and the digital infrastructure (connectivity and permanent service among others).

"... What we did was the design of teaching materials together the content to make it possible for not only everything to remain on the platform, our interest was not so much the platform, our interest was how to make the students not distance themselves from the course. What they were doing, that is the central point; how do you make a distance student, who you are not attending to, really discipline yourself to follow the course according to the guidelines? As a result of that we designed some materials of four compact discs with the contents, strategies, perspectives, all these things; In short, they forced the student to carry out the activities, since otherwise, it would harm everyone. The cross activities, so if you had an activity, if you did not do it, then you hurt everybody in their activities. Well, of course, the responsibility was being given to you insofar as you were responsible for the formation of these two and this cross form if it favored and had good results. It was a pedagogical strategy ... Hence we have a very high rate of graduates, practically 95% of the students who have passed the four versions " (Interviewee 1).

According to the researcher interviewed, over time, the use of ICT has practically turned into giving support to face-to-face teaching as a consequence of curricular designs that must fit in a face-to-face mode to accomplish the institution rules. The infrastructures become nearly

content repositories and for proposing and deliver tasks without a clear strategy. He also indicates the Bolivian idiosyncrasy makes the students wait to be in front of the teacher, to interact with the teacher, which will answer questions or make proposals.

"...Our idea was in the master program, which was entirely face-to-face ... to free some activities and resources with an ICT component. The former idea did not prosper much, because the strong weight in the face-to-face makes the same student not commit as much with the ICT use, he prefers to save himself the doubts and activities for the moment of being present with the teacher. We still have support in computing service, on platforms, but they have become practically repositories, there are the programs, the activities or tasks, the mail service and that is all. So this is highly complementary, we could practically do without all that, but we do not do it, because it has become a custom that we deposit programs, dossiers, files, images, videos there, but it is completely complimentary" (Interviewee 1).

Regarding the use of ICT in other educational areas such as higher and primary education, the researcher interviewee indicates they are used to support, above all, the distribution of materials and communication, through the use of computers, mobile devices and the applications that these provide. The most common software and resources are WhatsApp, platforms like Moodle, Facebook, and PowerPoint. The result is the underutilization of resources in environments not oriented to the teaching-learning process pushing all the effort in the face-to-face classroom again.

"To the extent that they are being used as a training medium, no; that if it is being used as a support medium, yes; There are several schools that use WhatsApp, platforms, Facebook, but that to exchange tasks, activities; to that extent if, simply as a complementary support medium" (Interviewee 1).

"I would say the use of technologies is positive. I believe we must distinguish in which it helps you; for example, things like communication: when they meet, when the task is delivered, the task consists of such a thing, deliver this, exchange of those things. But they are not necessarily oriented to the act of training, of teaching-learning itself, although of course, the effects will always be teaching-learning; but the separation between technologies and training act itself is the right thing to do. I can send my students, for example, homework through WhatsApp, and that is nothing and everything, but when is the teaching-learning process itself resolved? It is again in the classroom and face-to-face because that distinction is important to see. Using media of this kind is easy, you have it, on mobile phones, on tablets and that's it, but to think of another

way of using these media requires another type of vision, training, and thinking. How to use them, thinking about the logic that it has; which is different, because it is one thing for you to learn to use them, you are pending in the skill of using it" (Interviewee 1).

Educational ICT tools are complementary resources in the teaching-learning process. The teacher and student must be aware of the tools will help to improve the learning process; it is not useful to reproduce the traditional model into tools which need to apply different learning approaches.

"Another thing is that if you want to use them, it is like the PowerPoint, karaoke teacher is a filing cabinet where you put figures and read and expect the student also to read and learn from that. It is a point of criticism of many students, for that is what they call them, karaoke teachers (laughs). Still, another thing is that you use this resource as a complement to reinforce learning regardless of what appears, so you require a kind of change of vision about the resource, right? Not in the resource itself, but for what you want. And that is not very easy" (Interviewee 1).

Special education is inclusive in Bolivia, and the conditions of people with disabilities must be the same (UNESCO, 2010). The specialized software and devices to help children with special needs are expensive, and ICT usage is not used in public schools. Experiences like the second interviewee, with adapted devices to use computers through other parts of the body that are not necessarily the hands let teachers work with ICT and inclusion in schools. These experiences are a response to students' needs, to their curiosity about technology and the interest of teachers to provide an alternative solution. But the teachers have no experience with device construction, neither full access to the Internet and few of them involve in this kind of activities.

"They (children with impairment) see other people who are using technology, so they also want to use it. The focus of the law is inclusive, and we have to equalize the conditions of people with disabilities. Since 2010, thanks to a student with multiple disabilities who liked to play FIFA Soccer and had muscle spasms, he could not play it; he cried of impotence, so what do we do with this situation? We have looked for what tools we can use... but few teachers have become internalized in this. Teachers asking how can help with ICT to these students are rare. ... we have discovered an infinity number of applications that we are completely unaware. The first experience has been a software called EViacam that allows you to move the mouse and have access to the computer only with the movement of the head to control some action in the computer game, we have done those first tests..." (Interviewee 2).

"After that, I became a supervisor at a special education center in Tiquipaya, where several students with autism are trained. In this educational center, we looked for and used this EViacam, and we also adapted some mice. I brought a mouse for them to use, and we have decorated it so that it catches their attention because students with autism need it to get their attention. It is a simple adaptation, but it has given us good results; we have put some pulse buttons in a table and headphones together computers instead of a traditional mouse because the students with autism are equally attracted by technology. These kinds of students do not dominate motor skills, so when you say left-click or right-click, they do not dominate motor skills. As a result of this motor skills issue, we have looked for what we can do; and we built this (he shows the manufactured device). With this device they already handled the clicks, this like-mouse (shows the device) have built with wires and pulse mouse buttons, they are in a trapper with adequate separation between the buttons; the device has decoration to catch the attention of students with autism. They entered and operated the computer with this device" (Interviewee 2).

Although there are these kinds of experiences, the interviewee indicates there is still a lot to do and know; teachers, who have computers to support classroom learning, do not use them, except for very isolated initiatives. He rescues the contact with people who have different abilities and lets the teachers question themselves and seek help or technological support to improve their work.

"For example, there is a teacher who did not know how to make pictograms. In the subject of autism, she does a lot of work with pictograms, so she has seen a resource called ARASAAC[2], which helps you in communication with autism students. She had an idea of how to do pictograms but did not know how to take them to the computer" (Interviewee 2).

3.2 Obstacles to the introduction of modern ICT-based solutions in Bolivia

There is a lack of computer rooms or equipment, either standard or specialized schools. This low school equipment is a significant obstacle to introducing ICT in the educational process. The same thing happens in the classroom since a large percentage of teachers do not use the computer provided by the government in the school. But there is another kind of obstacles in the use of ICT to support distance education: the design of the virtual course, which are face-to-face, and the intention is

[2] An Augmentative and Alternative Communication System offered as an expression set other than spoken language, to increase and compensate for the communication difficulties of people with disabilities. http://www.arasaac.org/pictogramas_color.php

to use ICT for virtual support without any change to the plan. It leads to an inappropriate way of using ICT.

"It is alarming to see in the classroom the little use of technology. In 2012 the state provided a computer to each Bolivian teacher despite this, very few teachers use this as a tool to teach their students. Worse still is in the special education centers, it is rare for the use of computers by the teacher, or that a special education center has its computer lab is rare. Students with disabilities are surrounded by technology at home, like mobile phones. Still, sometimes the family restricts technology to people with disabilities because they think the children are going to damage it, so they limit the children's experience using this kind of device" (Interviewee 2).

"Maybe that is what we were talking about a little while ago: for what you are using it. I think if you design a course or a virtual training activity, the design itself already begins for those types of elements. Still, if you have not thought of them for that type of media and you have thought of it for a face-to-face vision, it becomes complementary, that is what has happened to us" (Interviewee 1).

The following reveals issues in actor training and for what ICT is useful. The interviewee considers how to use technology in education is misunderstood, due to a lack of openness in understanding the potential that technologies can offer and its use practically reduces to the generation of digital resources as a naive replacement for printed resources.

"You have an interesting issue in the sense of saying: if you train a teacher and are given technological skills, for what does she use it? Is it used to improve her teaching process? Or to, let's say, have the possibility of digital files on certain problems that are taught, part of daily life, let's say. It depends on what you are going to use it for, obviously, but the trend is this. One of these conclusions is: I believe that we are not very open to understanding the potential of technologies." (Interviewee 1).

Other point that highlights the limitations in the use of ICT is the sociological idiosyncrasy of both students and teachers. The objective to use technological resources for a task can dilute by how students are. As the interviewee stands a storytelling task becomes an emotional dramatization going away from the educational goal.

"The mandate was good; what teaching resources of the indigenous language can be elaborated using ICT. But see how it goes to practice distorting it because the results are that students prefer to produce dramatizations. Still, it seems a bit like the skill of storytelling where there are

some elements out there; what is striking is the use of the ICT medium to show the emotional experience of each student, not to enhance the technical education. Then the orientation of problems to the experience of migrants, abandonment of children, and the woman who is mistreated by society in the content media is not the goal of the mandate. Of course, the nature of a medium may address this kind of use; but, I think that is interesting because the limitation the user gives to this medium is by the distinctive sociological preference" (Interviewee 1).

Another important aspect when talking about ICT is the lack of knowledge of teachers regarding technology and specialized software to support students. The forms and customs of doing things are an obstacle when it comes to including technology in the teaching practice; since it is underused and in the long run, it does not have the impact that teachers expect. The teacher experience with ICT affects to students with disabilities, in a sense to get access to learning environments adequate for them; teachers do not know what to do when faced with a particular situation of having a student with a disability, in these cases, educational processes should adapt.

A requirement is to change the dynamics of the classroom for learning, not to replicate the traditional practices with the technology, like long magisterial class using blackboard.

"It seems to be another source where we can see this is the teachers: the government provides teachers with computers, but I have not seen the impact of computers in the classroom, in the teaching process. My daughter, who has finished school, by obligation, got a tablet. Still, if I see the contents of the course in the tablet it is really like a library, it is a repository of programs, activities that they have to carry out and all those questions, it is not necessarily a learning artefact. Because the teacher uses this device to send them their program, to review assignments, I am not saying that it is bad or that it is good. The devices can help in making an essay, or look at the multiple resources there are to teach math; which is not on the blackboard.... But it is because the teacher has not projected in his professional profile the potential that such an artefact may have. Still, also, our existing connectivity system is not so efficient. That is already telling you the logic, the technological culture here in Bolivia is still quite limited" (Interviewee 1).

"I think the teacher has a limitation in the educational pedagogical training; perhaps he has not been involved in ICT use or studying basic electronic-mechatronic. The teacher, who works in the classroom has endless ideas of resources. For example, a teacher wants to teach students with disabilities how to use traffic lights, and has seen those glasses (virtual reality), and says if someone could do it to me to simulate a

street, with traffic lights so that they live that reality without exposing to danger. They have initiatives, but, the limitation is we do not have those competencies to develop this type of resources" (Interviewee 2).

3.3 Hardware and human potential and ICT-mediated education

The new Bolivian generations, who have been born after 2000, have skills in the use of technologies. They are not finding in the primary or higher training system a way to exploit these skills. The new teachers are looking for this training abroad. He believes that this generation must be given the space for training in ICT in an independent way of their profession and even more.

"For me the issue is generational, well that is well known, it is not only my appreciation, you know that I study generational change and technologies, I think it is the context in which this issue must be thought. I see the new generations are going to say since 2000; they have that possibility, I think that potential would be there. These people are going to other countries because here they would not be finding a way to grow their potential" (Interviewee 1).

There is a need to start the training in the educational purpose of ICT tools and keep away exposing slides. This training is a responsibility of the educational institutions. The training must start in the service teachers, who have contact with the realities of special education and in training teachers. They see the needs of special education students. Some teachers in the special education system have experiences in the use and adaptation of technology and require an extra reasonable effort to learn about device adaptation topics not present in the teacher training. Many of the teachers have excellent ideas, but they have limitations to capture and deploy ICT adaptations.

"I believe there is the potential. You see very skilled people who are blurred in the same centers, in the institutes or if you see here at the University. You see very skilled people who solve software problems. Now, the sandwich generation, like me, access these resources and devices; we have the possibility, but we are still anchored in a tradition. If we use these means, we do not demand them; we do not squeeze them. Still, we are calm, I do not see any center that says or even proposes a policy on digital centers at the University, which we should do, but it is like we do not need..." (Interviewee 1).

"... The teachers have initiatives, but the limitation is they do not have those competences to be able to elaborate on this type of resources. Herewith the students from the ESFM, we have tried to replicate some

device adaptation experiences. It has been done because it is not too complicated, no in-depth knowledge is needed, we have tested which wires and circuits empirically and it has worked for us. This experience has caught the attention of some students showing the necessity to complement the training in these areas. I think it could be overcome, although it is a limitation, we in the area of education have little contact with technology. Teachers who use technology think it is to connect their computer to their data display and give presentations, doing the last they limit themselves. It must not be as it is now, it is extensive. I believe more things can be done, but we still lack it" (Interviewee 2).

3.4 The role of business in the educational sector

Our interviewees know of some initiatives of companies with schools for the provision of devices at reasonable prices. They also know some institutions offer training through technology workshops aimed at professionals outside the educational field. As far as the industry, it does not have a real impact in supporting the educational process, and his experience is more a relationship of economic order. There are unsuccessful experiences of approach to the most prominent software development industry in Bolivia searching for help to operationalize the teachers' ideas. Making strategic alliances and joining efforts between the institutions and the company is a pending task at the Bolivian level; for the support and collaboration of each party in pursuit of improvement in the special education process.

"At the level of agreements, the JALASoft Company has several agreements with schools. I am not sure if it is to support, coordination or training; for example, I know some people are going to train there, but they are graduates. I think there are agreements like to lower costs, for example in products. JALASoft offers tablets or laptops and sells to schools in an agreement at low cost, and technical service that has to do with hardware or software and that is all" (Interviewee 1).

"...we contacted the company JALASoft. This company develops software, but they told us to send a Project, they were accessible, they had projects in the area of education, but the educational management ended then nothing happened. It was always in my mind that someone who knows about ICT development can help us, for example, the University" (Interviewee 2).

"I think it is necessary to join forces to achieve true inclusion. As I tell you, the reality like the student who is included here (he is talking about the ESFM students) is harrowing because she does not understand what is being talked... We have presented all this material and many more ap-

plications aimed at people with disabilities at a fair for the ministry of education; unfortunately, has not interested them. I think it is necessary to make strategic links with some institutions that can help us with the development of educational material in the ICT area. For example, this (showing to the mouse built by himself) device; you are not going to find an adapted mouse in the market. We have searched and found in the Spanish market an expensive one, near to 75 Euros without transportation cost. This device is expensive, inaccessible for our society..." (Interviewee 2)

3.5. ICT and educational innovations in Bolivia

Our experience and assumptions from the experience of the interviewees are the knowledge in ICT applied to education are individual or low-cost projects not transferred to society. Some teachers have an interest in ICT education and inclusion; these teachers start replying experiences from the Internet and get it works for their class. Most of the innovations are solutions are tailor-made to the needs of the students in the special education experiments.

These innovations have to facilitate computer use or to improve aspects of their use in daily life.

"Speaking of which, just a colleague tells me: I have made a practice from platforms with my students on the topic of evaluation: because there are evaluation models, I made an evaluation and the idea was not that I evaluated the students, but they evaluate their learning through certain types of activities load by me in the model, and it works..." (Interviewee 1)

"In the special education area, where we work with people with visual, auditory, physical, and motor disabilities; the need is varied. A teacher, who had a student with visual disabilities, said she always had problems with the cane and with the architectural barriers; and suffered accidents, so she wanted a cane like a car that when she is going to collide emits a sound alarm, something so simple to incorporate on your stick and warns if there is an obstacle near to the user..." (Interviewee 2).

3.6. Support the development of ICT-related skills among people responsible for learning and digital inclusion

According to the first interviewee, support is required in two areas: infrastructure and training; both necessary and conditioning each other. Reflects on the need to provide better conditions in terms of services and equipment in spaces dedicated to education and the need to train

human resources in the proper use and potential of ICT. Training, especially for teachers, should not focus on the technical side of equipment and software, but in the conception of technology-oriented to teaching and research.

Infrastructure without adequate training to human resources is useless. The teachers need training in ICT for education drive by curricula and instructional design. The training initiatives need to respond to a vision allowing all efforts to be interconnected in pursuit of an educational purpose. There is an essential generational difference between teachers, a digital literacy gap that still needs to be filled.

"Maybe there would be two things to accomplish. One is in the field of services; I am referring to connectivity and access because first I believe the access must be installed and second for the access to work properly, you also have to give good connectivity, tools, and devices. It is one area, the other is at least to start a kind of training node for people who want to venture into ICT and education... you can have a good service all this thing, but if you do not have a center driving the generation of a critical mass, nothing happens either, because they are all scattered, right?. There is no interconnectedness of interests either, so I think you have to pay attention to both." (Interviewee 1).

"When talking about special education and people with disabilities, the word 'adaptation' will always be present, since nothing produced is intended for people with disabilities, you have to adapt everything... You find needs also on the kind of resources, which can help the student in the type of disability; for example, in the case of signs, the item of braille, an endless number of needs exists in special education..." (Interviewee 2).

3.7. Open educational resources and work with disadvantaged groups

The use of open resources is related to the design of the curriculum, according to the first interviewee, in Bolivia, there is a closed curriculum from the educational law; since it promotes training of competences for the current and internal market. He believes that open curriculum design is impregnating scientific knowledge that forces actors to observe what is happening in the world and can be a connection with the free educational resources. From their perspective, the curriculum directly influences how to share resources.

"I think it happens due to a matter that was presented to us when we did design, precisely in the specialty. It goes through what orientation the curriculum has, which is that conception. We have discussed it very

much; because it was necessary to be clear about what we wanted to do with a type of education which is remote and a theme that had to do with the training of educational managers for indigenous peoples, that was the framework. In other words, how we use the curriculum or what impact it may have on connectivity over these resources that you are calling open. Although evidently, the idea was that all the strategies and pedagogical design have that character" (Interviewee 1).

An alternative for the introduction of open resources in pursuit of inclusive and accessible education is training through technological schools. The school needs to cover three perspectives: technological training, technological thinking, education thinking. The technology is complimentary, and you need to think about technology, education and how to train it.

"Make a kind of node where you can deploy and respond to these demands, a small technical school, I think. Where unlike these other schools, you teach them not only technological training but to give it a technological thinking name. They are supposed to infect others is a good strategy, it works, it even applies to some cases of companies, where two starts, these two they spread to two others, there are already four, that's a strategy. It is a good possibility; it is a possibility that is neither bombastic nor raffles all at once. If some pedagogical strategy can be applied it is something like this because starting in a massive open way does not work" (Interviewee 1).

Education for disadvantaged groups requires and demands training alternatives. It is essential to have spaces in which other strategies cause a multiplier effect to benefit disadvantaged students. The alternatives include differentiated programs and individual attention. Since the training of competences should contemplate the particularities of each student and in these cases include the use of ICT to help him develop skills.

"Disadvantaged groups have many types of disadvantages; you have disadvantaged groups, for example, students from poverty, who come from rural areas, but there are also disadvantaged students who still come from schools. We are going to say 'good' in the city, and they are still at a disadvantage because the system has constrained them in that type of curriculum. For me, it is no coincidence that the University is becoming more widespread. The University teachers are aware the students are arriving without knowing how to study..." (Interviewee 1).

"...there are other disadvantages; those who have special abilities, but that requires another type of attention, it is distinct from having limited skills, right? I read an article, how to use technologies for deaf children

and a series of elements that allow them to display their skills like any other without impediments. I think the issue is, not to turn any program into a remedial plan, it must only have a component of a particular type of competencies" (Interviewee 1).

"Thinking of a visually impaired person, all the resources accessible in the platform are with audio that allows you to listen where you are. On the other hand, people with hearing disabilities, the platform could offer sign translation or the interpreter telling you in which sector of the platform you are or what you are going to do in that space. Finally, for the intellectual disability, what has wide use is the pictograms..." (Interviewee 2).

The learning content must be the same as the one for a regular student, which is the principle of inclusive education in the Bolivian law.

"Speaking about inclusion and education, they should learn the same things that others are learning, but differently..." (Interviewee 2).

Regarding people with a disadvantage due to their origin, for example, of language, our second interviewee reflects the ESFM is an inclusive educational institution. Still, effectively it is not paying attention to people who speak another language. The teacher is teaching in his speech or the majority speaker language as an imposition. In this field, work is on projects that oblige teachers and faculty students to learn Quechua (one of the indigenous languages spoken in Bolivia). In many cases, there is resistance. The strategy, in this case, would be the obligation through regulations to effectively address this context of disadvantaged people.

"We have two modalities of acceptance to ESFM: one to examine and the other for belonging to an indigenous/native/peasant student. It is a great difficulty in the subject of literacy and communication for the people who come from these contexts because they are Quechua culture, even though something happens at school. However, they still have these problems. It currently exists in our population." (Interviewee 2).

3.8. Support the use of ICT in learning and social integration in Bolivia in light of government actions

The law establishes the use of ICT in education; but, there are no policies of management taking into action the rules in the legislation. The training in ICT for teachers is low, and there is no training related to ICT for disadvantaged education.

"Well at least at the level of the law it is cited, it expressed the intention the ICT is going to be part of the training of new students. Another thing is that it is not done as it should it is lent very little attention, there is no technological planning unit in the ministry, for example, but this one is stated at least. As politics, there is nothing visible, at least, but it is fascinating that under the protection of the law..." (Interviewee 1).

"Although the Ministry of Education is working more on the subject of equipment and infrastructure, neglecting the subject of what is ICT and the preparation of teachers, such as I tell him all the teachers have received a computer, but we do not know how they are using it, so the Ministry of Education has ICT workshops, but they are not aimed at working with people with disabilities..." (Interviewee 2).

There are spaces like EDUCA INNOVA (https://www.minedu.gob.bo/) that promote the ministry, where teachers present their innovative initiatives; however, the majority directs to regular education and not pay attention to work in special or inclusive education.

"...fairs organized by the ministry are open, for all regular education and special education. Two years ago we presented ourselves, and we were the only special education center, everything was absolutely everything for regular school..." (Interviewee 2).

The activities promoted by government spheres such as the EDUCA INNOVA fairs are more to show teacher initiatives. There are no policies to encourage these innovation proposals beyond the festival. The result is not sustainable over time; the teacher presents the project but has no support to replicate. There is also no possibility of having access to the information of these proposals beyond the fair. Therefore, enthusiasm is born and usually dies in the space of the EDUCA INNOVA fair.

"The information is available only at the fair, they ask for contacts at that time. For example, I have been interested in the Augmented Reality Project of a school, at that time they explain how they have done it and tell you to contact me if you want more information and I got in touch, he said I would send you material, and the material never came to me, that happens, maybe it is a little suspicious, I don't understand, but as it says, this type of experience should be replicable, but in some cases, it doesn't happen" (Interviewee 2).

Discussion

Teachers play an essential role in the inclusion of ICT in education (regular, special, primary, and higher). In this understanding, the comput-

er provision to teachers by the project "one computer per teacher" aims to the use of technology in the teaching process and helps to improve the quality of teaching (AGETIC, 2018). The findings in AGETIC (2017) shows that the majority of students over fifteen years old have a mobile device, and is getting used with the applications installed on it. The experience and findings in Costas (2019) show that the use of technology is limited to communication and content distribution; the use is not as an instrument to support learning activities. The low-level technology knowledge is related to the low income of the majority of the population in Bolivia (Costas, 2019).

Teachers use platforms, unique applications for specific topics, and software to produce content (e.g. PowerPoint). The use of technology mainly for content production is a finding in the reports from (Farfan et al., 2015; Costas,2019), the interviewees state that the teachers widely use technology for content production.

From the perspective of academic planning, the curricular design in Bolivian education for all levels of education: regular, special and higher influences the application of ICT causing in many cases the underutilization or lousy use of ICT.

The teacher ICT experiences and the need to link the curriculum with ICT tools for the learning process is a perception of the interviewees and concur with the findings in Costas (2019). The challenge for teachers and students in Bolivia is changing the use of technology from communication into a learning tool. The interviewees mention the access to technology by teachers, but without adequate use in the education field. The interviewees state a need rethinking curricular designs to let teachers make changes in the classroom didactics.

In the case of special education, there is a lack of access to devices for impaired students; many devices are expensive and not available in Bolivia. Teachers have no experience, nor awareness of devices and software that are free and feasible to build locally; they need help from Universities and NGOs to work on this kind of ICT. The technological focus in special education is the use of ICTs to equate the conditions of study and improve the quality of students' life.

The following challenges in the ICT use for inclusion in education in Bolivia are:

- The teacher is a key person and responsible for the inclusion of ICT in education.

- Improve the connectivity, accessibility and availability of Internet
- Take advantage of the wide use of mobile devices by young people
- Include the use of ICT in curricular design
- Include in the classroom didactics use of ICT
- Promote Universities and NGOs in helping special education ICT tools awareness and accessibility.
- Awareness about cultural and idiosyncratic situations

The reduction of the digital divide in Bolivia has the main improvement in the access to the Internet by mobile devices, which has a broad penetration in the Bolivian society (Marin et al., 2014; ATT, 2019). The accessibility and connection speed are a persistent problem related to the quality of the service. The strategic plan PRONTIS, (2014) is to improve the accessibility to the technology by Bolivian population; the goal is to provide electricity and internet access to each community around the country until 2025. The PRONTIS implies the provision of computers to teachers and students. It includes the complete installation of the infrastructure to have computer laboratories in schools. Yet, today, not all schools have access to services such as the internet and electric power as well as adequate environments for their operation, and only the best-equipped schools receive the technological bases.

The reduction of the digital divide in particular in the area of education is the result of actions carried out since 2011 with projects like "One Computer per Teacher", "Community Educational Telecenters" and the inclusion of ICT in Initial Teacher Training (IIPE, 2014). The Complementary Training Program for teachers of the Plurinational Educational System of Bolivia (PROFOCOM) offer workshops training in ICT use, mainly in regular education (Costas, 2019). These actions are the starting point to increase the use of computers by teachers. The training of students efforts mentioned in (Costas, 2019) are projects not coordinated between the government and NGOs, the lack of coordination shows the students still using technology for content search and entertainment.

In the case of special education, the absence of computer rooms and the lack of attention to teachers in terms of technological support, training and knowledge to express their ideas, are obstacles to overcome.

The following are obstacles to overcome in regular and special education:

- Improve connectivity, availability and accessibility
- Lack of ICT equipment in educational units
- Reduce the digital divide in students
- Boost classroom didactics
- Teacher training in ICT as a complementary educational tool

In the Bolivian context, there are spaces like EDUCA INNOVA[3] and programs from the Ministry of Education for the training of teachers (Ministerio de Educación, 2016). The training plans have specific workshops related to ICT as a requirement for all graduates from PROFOCOM. The former is a requirement for the teaching practice, but the training gap persists and does not fill the need for competencies by the inclusion of ICT (UNESCO, 2011).

The application of ICT in education requires the assistance of different sectors and people, but undoubtedly teachers must be considered in their essential human potential. Supporting the teachers involved in special education is important, especially in training for pedagogical purposes and supporting classroom improvement initiatives for disadvantaged.

It is essential, in under developing countries, such as Bolivia, to incorporate the use of technology into education. The incorporation of ICT in Bolivia will need efforts, economic and trait approach with technology. Bolivian teachers and students need not only to learn to use technology in the learning and teaching process, but also convert it into a tool for this process. In the work of (Voogt, 2008), there are two routes to cover for education: social, and pedagogical. The former is about learning the necessary skills in ICT incorporated in school; the latter refers to the educational view; it means to think about teaching and learning, including ICT in the education process.

Regarding the point of analysis of Hardware and human potential and education mediated by ICT are the teachers, so the challenge is to work on:

- Encourage initiatives to improve ICT educational use by practicing teachers
- Strengthen the training of technological capacities of teachers

[3] http://educainnova.minedu.gob.bo

- Improve the competencies of practicing teachers regarding ICT

In the case of Bolivia, our interviewees know that some companies have agreements to provide equipment to schools and recognize they are ready to give support to improvement projects in education. Although their participation looks minimal, the results will be useful to join efforts to enable the company collaboration with teachers who demand their involvement.

There are references to projects from companies in favor of education, as shown in (JALA, 2020; Tigo, 2020; UNDP, 2020). The projects range from the development of teaching material through educational videos to initiatives to alleviate the problem of connectivity. Other experiences (Rojas, 2011) have to do with the support of infrastructure to build virtual networks to share information and support interest groups, in this case, teachers.

Our interviewees refer to some initiatives that relate the company to education but consider that their participation is still low, the suggestion is to join efforts so that the company can collaborate with teachers who demand their involvement. They believe that providing solutions to problems that arise in special education can be a good start for organizations.

Regarding the role of the company in the educational sector, there are the following aspects in which it is necessary to work:

- Improve the incidence of companies in support of regular education

- Promote a business-education relationship that allows solving specific needs

- Promote a channel for the dissemination of company contributions in education

The interviewees' comments about innovations are a response to the needs of the students and teachers, who creatively want to respond to situations that arise in the classroom. Apart from the motivation they have, it is essential to provide spaces where these innovative experiences are made known or even areas to make their needs known. Currently, there is a space promoting innovative initiatives by teachers, the EDUCA INNOVA fair, in the EDUCA INNOVA site, there is a gradual change over time in the use of technologies and media. Each year the resources and the topics the participants introduce are related to specialized devices and even to the construction of basic hardware to encourage teaching in the classroom(see http://educainnova.minedu.gob.bo). This reality is con-

sistent with the interviewees' comments regarding innovations, which respond to the needs of either students or teachers, who creatively want to apply new alternatives to situations that arise in the classroom.

Some aspects to promote in educational innovation are:

- A repository of the experiences related to innovation in education
- Support for innovative initiatives
- Promotion of innovative initiatives

Specialized support for the development of skills related to ICTs among the people responsible for learning and digital inclusion, requires a critical training component, which allows meeting the specific and specialized needs in the care of disadvantaged people. Students with disabilities live surrounded by technology, and many of them are striking, so it is an opportunity to use this fact for educational purposes. However, to achieve this purpose, work must first be done on its use and then on adapted resources as potential teaching aids.

The provision of a stable, reliable and accessible infrastructure in controlled spaces requires trained people. These trained people must respond quickly to problems that may arise when including ICT in the teaching-learning process. In Bolivia, this scenario is present in higher education institutions, but in schools is practically non-existent, public schools practically do not have access to the Internet, and some private schools use communication platforms.

Support the development of ICT-related skills among people responsible for learning and digital inclusion require the following:

- Constant digital literacy programs
- Develop interconnected training programs for the different actors (teacher, student, school administrator) in digital inclusion
- Develop skills and knowledge in the use of technology-oriented to teaching and educational ICT research

Open educational resources and training disadvantaged groups with ICT need a lot of work according to the collected perceptions. The uses of these resources should respond to open curriculum design; however, when speaking of a sector of disadvantaged groups, the use of these resources is an enjoyable and quick alternative in response.

Open resources provide a wide range of possibilities in the field of education. Having tools catalogued as open resources, allow their use and become the main basis for the inclusion of ICT in education. Open educative resources are not a field of exploration in Bolivia. Thorough knowledge of an OER is very important in the training of an educator, whether for evaluation, production or use.

The innovations that teachers show within the framework of EDUCA INNOVA, lack a dissemination mechanism, and the experience sharing is a pending task. There is still no culture of having free access to the projects and their resources. One of the interviewees suggests that open educational resources are per an open curriculum design. In the case of Bolivia, the curricula have a closed trend, which may influence the generation of OER.

Regarding the attention of disadvantaged groups, the Bolivian government has taken actions that allow providing education to different sectors that are disadvantaged to reduce illiteracy through alternative education (Ministerio de Educación, 2017). In the document (Ministerio de Educación, 2012) the curricular and methodological guidelines of inclusive special education with the help of ICT tool; But, in practice, there is a lack of knowledge in the ICT tools to apply in special education as the interviewee stands.

The challenges need to face in working with disadvantaged groups, and the use of OER are:

- Teacher training in open educational resources
- Higher education alternatives other than university for disadvantaged groups
- Promote the construction of open educational resources
- Education for disadvantaged groups are opportunities for the inclusion of OER

Regarding the use of ICT in learning and social integration from government actions; is right to mention the educational law ponders aspects of training for all, multicultural and inclusive and considers the use of ICT to improve education. A proper space for teachers to show their initiatives is EDUCA INNOVA. Teachers see this activity as a showcase to show creative efforts. Still, they do not have continuity since there are no policies to make these initiatives sustainable or replicate them to other units. They comment that the financing of these initiatives is personal and

in some cases supported by NGOs represent costs covered by teachers if they want to use this promotional space. In this sense, teachers require the generation of action policies that in turn allow the Productive Cultural Society educational model to get useful in the classroom and society, in the spirit of right investments in the educational field.

Regarding the use of ICTs in learning and social integration from government actions, it should be mentioned that the educational law contemplates aspects of training for all, multicultural and inclusive and considers the use of ICTs in improving education.

The regulatory framework from Ministerio de Educación (2016) establishes the use of ICT in the educational system following the training for all, multicultural and inclusive aspects of the education law. But the framework has limitations in the connectivity and accessibility to the Internet; the same applies to technology. The government should take actions to succeed in advance of the education system and ICT use in education.

Both interviewees consider insufficient progress regarding government policies and law related to ICT for regular and special education; the reality does not reflect the policies in the documents. Both agree that laws exist and that the foundations have been laid to reduce the digital divide in a first facet; it is time to move on to the next step.

Regarding the support for the use of ICT in learning and social integration in the light of government actions, teachers demand:

- Training in the use of ICTs in education specialized in inclusive education
- Sustainability policies to innovative projects presented by the teacher
- Policies that allow the replication of good experiences
- Investments to aim sharing and replication of teacher experiences of EDUCA INNOVA fair
- Training in the use of ICT in teaching, on all specialized inclusive education

The experience accumulated on ICT applied to educational programs aimed at indigenous, always taking care of the indigenous as community and culture, is necessary. Clothey (2015), agrees there is a few research about ICT for promoting educational access for indigenous population

and sharing experience results between scholars and teachers is mandatory to improve the results from past experiences. The first interviewee is relating to the experience of education helped by ICT oriented to indigenous communities. ICT has capabilities and resources to promote and improve education for indigenous populations using their cultural values, as suggested in Clothey, (2015).

The results presented in this document show the perspective of two teachers with experience in ICT and education, one from the University and the other working with education for the people with disabilities; from the Bolivian reality regarding the inclusion of ICT in education. For this reason, the results are not irrefutable facts, however probably a set of them give an overview of some aspects with which many agree. In any case, the objective of releasing opinions regarding the. The use of ICT from two different perspectives has allowed us to find common ground and raise concerns about the exercise of ICT in education. The result of the study is useful information for teachers and stakeholders related to education in Bolivia. The results will help in the reflection and understanding the ICT use in education and evolution in contrast to experiences from other countries.

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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).

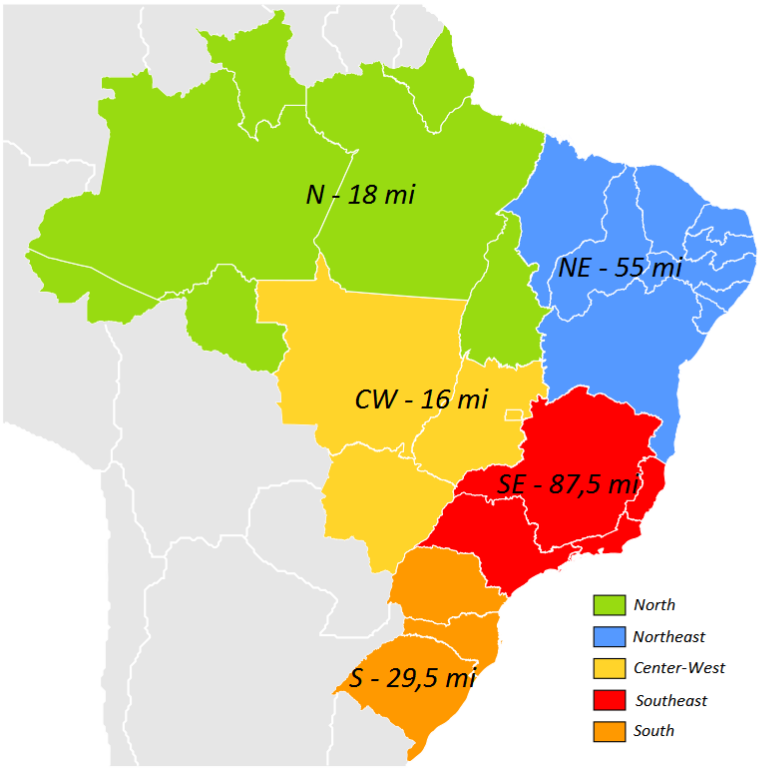
In this scenario, the infrastructure and training of professionals that provide the use of ICTs is far below the current needs of Brazilian education. According to a 2018 OECD (Organization for Economic Co-operation and Development) report, the lack of clear objectives on the use of ICTs for learning, 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.

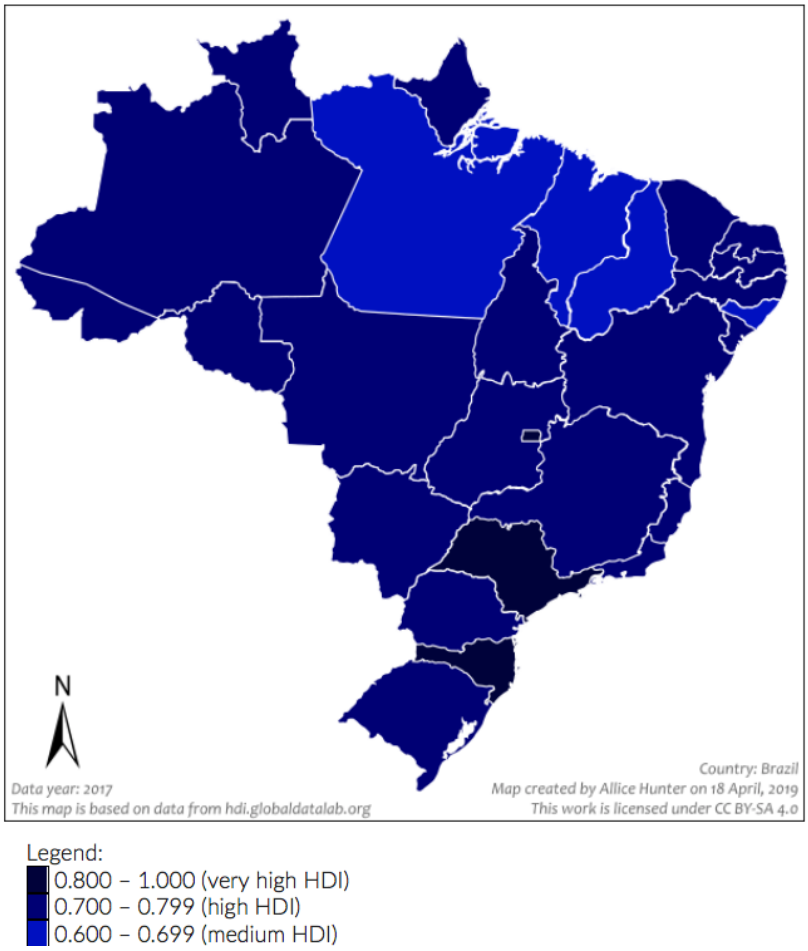
In spite of many inequalities that are common to every developing country, Brazil counts 99,3% of their children between 6-14 years-old in schools, but is still coping with an illiteracy rate of 6,8% (Brazil, 2020). Maybe the only non-inequality that is officially perceived in the Brazilian territory 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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The role of ICT and its pedagogical contributions to education in the Dominican Republic: Advances in educational innovation for inclusion and technological literacy from the perspective of higher education institutes, policymakers, and ministries

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Abstract

Information and Communication Technologies offer innovative tools for inclusion and education. In the following paper, it was investigated questions related to the implementation of Information and Communication Technologies in education for the construction of knowledge and digital inclusion of populations with diverse characteristics, capacities, and disabilities in the different educational levels in the Dominican Republic. The strengths and weaknesses of the educational system was the approach of this investigation, describing the participation of private and governmental institutions in the development of educational technology. The qualitative method was used for data collection. To respond to the nature of the problem, the study used the interview as a data collection technique and as an instrument the interview script (questionnaire). The research aimed to a sample with expertise in Information and Communication Technologies as a means of learning in the Dominican Republic

and then carrying out the analysis of the data through the interpretative model of qualitative research.

Keywords: Information and Communication Technologies, Dominican Republic, pedagogy, innovation, Education

Introduction

Education in the Dominican Republic is a fundamental pillar for the development of society. Teachers play a primary and essential role in the educational process to be reliable. They have to implement strategies, actions and activities that support their work, taking into account the characteristics of the group of students and the context where the academic content is going to be developed through the incorporation of ICT that allow the student population to interact with these tools stimulating the teaching and learning process pedagogically. In this context, Marqués (2016) indicates that teachers must use ICTs effectively and efficiently in their professional activities, and to achieve this they need to use the programs and resources of the Internet, but more importantly, they need to acquire academic skills for the use of all these ICT tools. For this reason, the Ministry of Education, through the Digital Republic program, promotes basic, continuous and ongoing training to teachers, students and the community for the inclusion of technological tools in educational processes by providing multimedia and computer resources in national educational institutions of the country. Similarly, private educational institutions have also made significant investments to keep updated with the technological demand that society is currently experiencing and to be able to offer tools to students to confront the digital age positively in technological learning environments, supported by the guidance and skills of teachers. Viñas (2015) defines the digital competence of teachers as the ability to locate, evaluate, use, create and share information. Propose and evaluate tasks in a digital environment, as well as handle solutions for cloud storage, use of social networks, create multimedia presentations, edit images, capture and manage information as well as publishing and sharing content on the web, all through essential tools. Considering the above, it is essential to conceive that the incorporation of any technology in teaching will lead to the modification of the teacher's roles, causing the demand for innovation, and transformation of traditional roles, organization, and planning of classes, to offer students the opportunity to use the new learning scenarios that ICTs provide.

The research aimed to value the experience of teachers and participants about the use of ICT and intelligent learning ecosystems. In this same order, the main limitation of the study was the level of technical skills of the participants.

Territory and characteristics of the Dominican Republic sample

The study conducted between November 2019 and February 2020 in Santo Domingo, Dominican Republic. Three professionals with expertise in areas related to education were interviewed. The first one is the Gen-

eral Manager of the Digital Republic program of the Ministry of Higher Education, an entity belonging to the Dominican state. The second is in charge of the Educational Inclusion Division of the National Council on Disability (CONADIS and the third is the Director of the School of Information Technology of the Universidad Pedro Henriquez Ureña (UNPHU) and a technology advisor in the business and educational areas. The interviewees were chosen because of the observed relationship of their experience with the indicators, dimensions of the study theme, each socialization for data collection was carried out in the field of the selected sample and had an average duration of 40 minutes.

The first interviewee (R1) is a representative of the program Digital Republic of the Ministry of Higher Education and serves as the General Manager of the program of the entity that is responsible for promoting and training in technology in the university field. He has two years in the position and more than 15 years of experience linking the private enterprise with the university centers; also, He participated in the program one to one where a personal computer is assigned to each teacher influencing the updating of the curricula, and Electronic Engineering graduate with Masters in Telecommunications and Pedagogy.

The second person interviewed (R2) is currently a teacher at the Faculty of Education of the Universidad Autónoma de Santo Domingo (UASD) and is in charge of the Educational Inclusion division at the National Council on Disability (CONADIS). She is committed to the coordination and monitoring of public policy formulation processes and the implementation of programs aimed at ensuring the inclusion of persons with disabilities in the education system at all levels. She has a degree in Basic Education, a diploma in Early Childhood Education, and a master's degree in ICT in Education and Management of Educational Centers. She has more than ten years of professional experience in various areas of public and private education.

The third interviewee (R3) is the Director of the School of Computer Science and Advisor to the Rector's Office on ICT matters at Universidad Pedro Henríquez Ureña. He has worked on national and international projects at the educational level. He has been in the field of information and communication technology (ICT) since 1979, in teaching, research, software project management (SCRUM), consulting, management, planning, and development of solutions for commercial purposes. His main areas of professional practice include e-government practices, collaboration, banking, savings and loans, group decision-making, strategic ICT planning, and ICT organization. Since 1989, he has been involved in the development of computer-aided learning applications and tools, including e-learning and web environments for collaboration and group decision-making. He has extensive experience in managing web develop-

ment projects, including large portals, business intelligence applications for statistical purposes and web applications and tools for government and private institutions in several countries (Peru, Costa Rica, Dominican Republic, Honduras, and Canada).

Results

Implementation of ICT in schools and other educational institutions

For the third representative, ICT has strengthened asynchronous communication, through the implementation of virtual platforms for learning as a space to search for information (Moodle), which are used as a means to build knowledge or as a space. He says that in "The context of Dominican higher education: The use of Moodle and similar platforms, either as a repository of materials or as a platform for asynchronous interaction is, in my opinion, what has been promoted most at the higher education level. In our school, we are in the process of introducing STEM learning, something that in basic education in other countries has been strongly encouraged with success" (R3).

Considering what the interviewee said, it can be observed that the implementation of virtual environments as a learning resource center, betting on the evolution of education through innovative learning methods that adapt to the needs of the student population, integrating knowledge areas through the STEM model of learning. About this, Gil (2017) considers that they are indispensable for the teaching practice since they allow students to improve their autonomous learning, encourage their initiative and interest, and speed up communication with the teacher in an advanced technological environment.

Reinforcing what R3 said, the second interviewee also emphasizes that technology allows the establishment of better synchronous and asynchronous communication channels between those involved in the teaching process and to be able to expand the information between the different stakeholders in the process. It is the case "of the CLASSDOLIO application that allowed daily communication between teachers, students, and parents" (R2).

In the same order, the General Manager of the Digital Republic of Higher Education has achieved significant technological advances where teachers, students, and the general community of higher education institutions have been taught to read and write in ICT, establishing agreements with private companies to offer quality technological resources. For this reason, the interviewee highlighted the one-to-one project, "where each teacher and student in higher education is offered

a computer, which seeks the educational use of ICT. Impact on: 18000 students and 2000 teachers. Using Office 365 platform for teaching in virtual environments" (R1).

It is important to emphasize that part of the development of education in a country is based on the various alliances that the state and the private sector can establish to design innovative strategies that raise the quality of education through complementary skills and resources to achieve the objectives of change, improvement and educational development since education should be of interest to all segments of society. Although it should be a priority for the state, the private sector plays an essential role in the development of the state, so the state must promote coalitions to strengthen the quality of education, increase awareness of the importance, increase funding opportunities and add value to the management of their programs and projects.

In the same way, the person in charge of the educational inclusion division of CONADIS expresses "...that the technological resources favor the teaching and learning process, that in her experience teaching the Spanish language in the classroom she used the digital blackboard as a resource. The school offered many opportunities for the use of technology, and I got so involved that with the time I became a coach of the ICT program for the Spanish language" (R2).

It can be seen that various technological resources allow for the more efficient development of the academic content of the study programs. It is only necessary to implement them correctly to take full advantage of the benefits they offer, added to this the willingness of the teacher to advance in the technological and digital divide to innovate their classes will be of great importance to achieve the academic objectives and equally to offer diverse learning opportunities for students, adapted to a variety of stereotypes for the construction of meaningful learning through group socialization in school environments. In the same vein, "At the school where I worked, I implemented the use of the IPAD as a tool for the development of student tasks; in the same school, they used Apps and digital books of the subject of the Spanish language" (R2).

It is important to emphasize here, as Angel Diaz-Barriga does, in his writing "TIC en el trabajo del aula. Impacto en la planeación didáctica", that, given this situation we must "bear in mind that their incorporation is not limited to (...) having the tools that make up these technologies: equipment and computer programs, but that the most important thing is to build an educational and didactic use of them" (2013, p.5).

Barriers to the implementation of ICT resources in Education in the Dominican Republic

At the moment of implementing technological resources in school environments, barriers must be identified before their incorporation to ensure optimal use of the tools and thus achieve the planned objectives. About this, General Manager of Digital Republic indicates, “that there are two main barriers in the Dominican Republic which are resistance to change and economic status of the people” (R1).

On the other hand, the second interviewee reaffirms that “the resistance to change, teacher´s socioeconomic status and the lack of training in ICT tools would also be a major barrier in the country” (R2).

It is essential to point out how the attitude of resistance to change in teachers’ teaching patterns becomes a threat to the incorporation of technological tools offered by ICTs in education, which can bias students towards technological environments that allow them to take full advantage of resources, activities and technological elements that promote the construction of knowledge for meaningful learning. Another important aspect is that the population that chooses to be a teacher in the Dominican Republic comes from low socioeconomic sectors, which makes it difficult for some to have easy access to the acquisition of technological tools and, at the same time, not have solid skills in handling them. In this sense, Tapia (2014) states that "It shows that even though a teacher has a positive perception of ICT, he or she does not make use of these tools".

In the same order, the Director of the School of Computer Science at the Universidad Nacional Pedro Henríquez Ureña indicates that “the preparation of the professors and their availability of time to dedicate to innovation work” (R3).

In this sense, teachers today are faced with technological advances and the break with traditional schemes, providing skills to channel learning in a transformative way through plans and updating programs that allow them to consolidate their educational work, obtaining skills and competencies to develop work with efficiency and effectiveness. However, teachers must have time to rethink teaching methods involving ICT as a cross-cutting theme.

Reinforcing the above, it is important to emphasize what González and De Pablos (2015) have said: “The most relevant impediments to the use of ICT in the teaching-learning process are related to the role played by the educational institution in promoting pedagogical changes, so it is essential to rethink structural aspects of the organization”. This identifies

that not all barriers are on the responsibility of the teacher. Educational institutions should also promote and establish technology literacy plans to strengthen the competencies of academics, to increase the meaningful use of ICTs in the classroom and to engage students in constructive learning processes based on technological tools. This coincides with the viewpoint of the second interviewer, who said, "there are teachers who do not know how to use Word, or how to write an e-mail, and who enter schools without validating the minimum technological skills to implement them in education, and the curricula of universities that train teachers to present a gap concerning the use of ICTs" (R2).

Hardware and human potential for education through ICT

The person in charge of CONADIS states that "there must be a relationship between theory and practice, and there must be a pursuit of technological knowledge at the various levels of the education system" (R2). Similarly, the first interviewee states, "...there must be a curricular transformation in universities to be able to respond to society's integral demand for the various areas of technological knowledge, and the ministries of education, universities, and business must be aligned" (R1). Continuing with the idea, the third interviewee expresses, "it is important to universalize STEM education" (R3). The presence of technological equipment in educational institutions is part of the process of transformation in training environments. This process must be accompanied by training plans for teachers so that they acquire the skills and abilities needed to implement these resources in teaching practices. This will allow to enter the STEM learning system, inverted classroom, augmented reality, robotics, virtual reality, which have gradually been taking prominence in education and providing strategies and methodologies to teachers and students to develop academic content through the use of ICT.

Following the same order of idea, the Digital Republic Manager said, "Programming languages should be taught in schools, identifying and directing these talents towards research." (R1). This will allow students to have a broader vision of what the future holds, since they will be able to have formal technological experiences that will promote the development of innovative ideas for the intrinsic development of their learning. It also indicates, "...so far this year there have been three calls for ICT-related diplomas, impacting approximately on 6 thousand students and professionals in computer science and technology..." (R1).

It is necessary to emphasize the effort that the Dominican state is making to incorporate ICTs both in the education and in the society. For that reason, it is seen the advances of the program of digital republic, that

has as purpose to provide laptop and tablet as resource for the learning, supported in trainings for the technological literacy and the development of diverse branches of the computer science, to answer the needs that the society of the information and the digital era demands.

The role of the business sector in education

The link between the business sector and the educational field has a fundamental value in the development and growth of society. The power to merge these two sectors will guarantee the provision of real opportunities to the educational population of the country. Concerning this, the third interviewee points out that "in the country, there are various companies that have foundations that support education in the country, as is the case of FUNDECITEC, which offers robotics programs for children and young people who feel the desire to be scientists" (R3). For the Manager of Digital Republic, "the workshops that are held between the software industry, academia and experts serve to identify the needs, vacancies, and priorities that the country has in the field of technology, but there is no evidence that there is a mechanism to ensure that companies contribute significantly to education" (R1). In this order, the CONADIS manager comments, "...there is no evidence of actions to improve education, only indicators of the demand for the labor that is needed, but no strategies are observed..." (R1). It can be seen that the presence of the business sector in education is focused on offering information so that universities can add indicators to their study programs. However, there is no clear evidence that there is an excellent contribution to providing technological resources, plans or programs that support the strengthening of Dominican Republic education. About this, the second interviewee points out that "Entrepreneurs are supportive in saying the skills you need, but they are not investing resources, and universities are teaching other things that are not completely aligned with current demand" (R.2)

In order to achieve a link between companies and education, it is important to promote business transformation in its social responsibility. As expressed by Zamora (2016), "they imply a change of chip, going from small and isolated projects to projects that generate strategies capable of integrating their different work areas, illuminated by their teleology and that are visible to the communities and integrate different sectors or organizations, carrying an implicit common objective: to generate change and multiple benefits."

To generate a significant change in the Dominican society, corporate social responsibility needs to focus on supporting the development of education, integrating projects that encourage the human talent that makes up these two sectors to materialize ideas that can be visible in

society, and that serve to promote educational transformation that responds to the forefront of the country's progress.

Educational innovations in the Dominican Republic

The significant advances that ICT affect various sectors of society and generate change in the curricula of universities. Careers taught in higher education institutions should correspond to social and business needs. For this reason, colleges have incorporated various technological resources as a means to build knowledge, but the existence of these resources in academic environments does not guarantee innovation in the classroom. López and Heredia (2017), refer to educational innovation as the "implementation of a significant change in the process of teaching and learning, the materials used for it, the methods of delivery of the sessions, the contents or the contexts in which teaching takes place" (p. 18). The innovation must produce a learning strategy that the teacher develops taking into account that technology present on the campus provides students with learning experiences where the fundamental axis is the constant interaction with technological elements. Regarding innovation, the third interviewee said, "that in the country there is a robotics and software development program that has had a good impact on Dominican schools" (R3). The effort to innovate education with the programs mentioned above and their dissemination is evident as well as the significant advances in the Dominican society. However, the same interviewee emphasizes that, "Although it could be much greater if there was more investment in teachers" (R3). There is a need for universities to promote technological training programs to encourage teachers to innovate their pedagogical practices, to understand that the technological era is changing and impacts directly on students who demand new ways of teaching and teachers who can meet the requirements through strategies to build knowledge by integrating various areas. Fernandez (2017) said that "it is necessary to incorporate technologies from the mediation teacher/tutorial and incorporate them to face as part of teacher training because without a teacher who uses ICTs properly the road can be truncated".

The leaders of education in the country must assess whether innovation is taking place in the sector or only in educational institutions, which are being equipped with technological resources. At this point, it is interesting to note what the inclusion responsible person of the CONADIS said, "there is general confusion with the term innovation because it is believed that innovation is synonymous of having technology in schools and it is not. We see an effort to provide technological equipment. However, we do not see clear strategies to increase benefits for education since it is used as a means of disseminating content" (R2), that is why educational institutions must structure mechanisms to encourage teachers to train themselves to innovate their pedagogical practices. Concerning

this, Jerez and Silva (2017, p.25) "propose to classify educational innovation, depending on its level of scope and space for action, into small-scale innovation of teaching routines and disruptive innovation" It is to see innovation as a transversal axis of the educational model of the universities, which has an impact on all those involved in the educational process, i.e., curricula, teachers, students, evaluation methods, which becomes a fundamental principle for the institution.

Similarly, the first interviewee emphasized that "there is a national strategy of entrepreneurship, where students of technology and business can work together on innovation through business model competitions" Achieve knowledge transfer through technological resources invites to develop a management model that triangulates research, entrepreneurship, and society to develop innovative projects that impact the various sectors of the community and at the same time respond to the needs present in the various areas of social ordinary. That is why Flórez-Trujillo (2019), "raises the latent possibilities of this emerging model, which is more and more accepted by society and is gradually taking away from traditional education" The innovation must be of the whole educational model and cannot be focused only in the classrooms. Likewise, the author affirms that "it is necessary to emphasize the appearance of methodologies of innovative service based on diffuse logics for the joint construction of interactive learning environments, which in a living way are adapted to the needs of the actors of the chain of value".

In this way, we can see the great challenge that colleges in the country must face in regard to expanding the vision of the educational model that they wish to develop and that responds to world trends to provide favorable conditions for students and approach the demands of educational innovation under the technological premises.

Development of ICT-related skills among people responsible for learning and digital inclusion

For the development of ICT skills, continuous training sessions are fundamental to build and strengthen knowledge related to resources, tools, and technological elements for learning. For this reason, the inclusion responsible person of CONADIS comments that it is necessary to "generate effective training, improve the technological skills of new teachers and those currently in the system" (R2). Similarly, the General Manager of Digital Republic stated that "..teachers should be trained through courses, seminars, and workshops" (R1), as well as "that there should be a focus on quality rather than quantity" (R2). In the same order, the third interviewee states that is necessary "training for innovation in ICT and STEM" (R3). It shows the importance of training active teach-

ers in the Dominican educational system. Pozuelo (2014) demonstrated that "training in digital competencies of teachers is a key factor in driving methodological change in teaching work, and shows that more technologically trained teachers use ICT more often, introduce more changes and promote ICT competence in students," this effort is demonstrated by the national government and can be seen in the author's statement. "The MINERD programs in robotics, software, and similar STEM elements were a good start but the programs have not been developed with the necessary impact" (R3). In order to guarantee the quality of training programs, it is necessary to establish evaluation and strict follow-up mechanisms in order to measure the impact and to be able to experience the innovative benefits that teachers can develop after receiving training. The first interviewee said, "An observatory should be set up to collect evidence of the evolution of training." (R1). Claro (2010) mentions "that in order to understand the relationship between ICT use and student learning, it is necessary to observe the types of use given to these technologies," in the same vein, Hernández, Ayala, and Gamboa (2015), "finally evaluate their use of these tools. This would make it possible to identify their level of use and integration of the potential of ICTs in the teaching activity, as well as to manage the definition of lines of action and training routes that will make it possible to integrate technology resources and tools optimally" It is essential to emphasize the fundamental role of evaluation and monitoring in the process of training teachers in technological skills for educational innovation. It allows evidence of whether the training strengthens the skills of teachers to develop meaningful learning strategies based on technology, as well as mediating whether the learning experiences of students have elements of innovation that drive them to the construction of knowledge.

Open educational resources and work with disadvantaged groups

For the second interviewee, "the methods and strategies meet Multiple intelligences (presenting material in different formats) and universal learning" (R2). For the first interviewee "to provide labs for teachers, certification of teachers in Microsoft because it is the only one in the country that currently meets the requirements for this type of education" (R1). The third interviewee mentioned: "What the country needs to do is create Open Learning Computer Megacentres.with hundreds of computers connected to the internet and free access to services for everyone, including disability considerations in each center." (R3). It should be noted that currently, that terms such as flexibility, adaptability, and accessibility of information, the ability to interact and build knowledge from anywhere in the world, at different times and addressing different needs are very popular. Thus, open education offers the possibility of putting these ideas into practice. However, it must be a joint effort between the

state and the education sector. For the person in charge of Inclusion at CONADIS, the disadvantaged groups have to "use different methodologies, accessible resources, in various formats, resources that can be read on any device, using collaborative work with a personalized teaching methodology." (R2). In addition, the first interviewee expresses, "the government makes available digital rooms with the equipment, connections, prepares the content that is available to students and the Dominican web portal for the unification of all the databases of the country's libraries for access by all students and teachers with diverse conditions at the national level" (R1). The use of ICT must be in an accessible way, to promote social, educational, business and cultural actions, to encourage innovation for the integration of diversity and disability, to raise awareness in all sectors and society to create awareness towards people with disabilities. When working together, teachers, educational institutions, government entities, and the private sector the universe of the diverse population impact increases considerably.

An example of this is the accessible virtual library designed in Argentina in 2014 by the Ministry of Social Development of the Nation, aimed at people with disabilities (www.desarrollosocial.gob.ar/biblioteca) and the obligation for mobile phone companies to sell equipment for people with hearing disabilities have begun to take effect. Supporting this, the third interviewee states, "In developed countries, the same elderly people educate others. In the morning, in Taiwan, for example, the parks are full of older people (and younger ones), teaching all kinds of things. The government encourages these activities, which benefit not only older adults but the general population" (R3).

Government support for ICT use and educational inclusion

Governments play a decisive role in the development of policies, norms, guidelines, and innovations in education. The Dominican Republic does not escape from this reality, and through the various bodies that direct the nation's education, the plan for a digital republic has been developed, which aims to promote the use of ICTs in the teaching and learning process, providing teachers and students with technological resources as educational support. "As for the use of ICTs, the most valuable thing the government has done is to give students personal computers and Internet access in their homes" (R3). Similarly, the second interviewee reaffirms that "through the Digital Republic Program, the state tries to respond to the inclusion of a large part of the population that is excluded by various economic and social factors" (R2). The first interviewee tells us, "Through the Digital Republic program, soft grants for graduates, delivery of technological resources, among others" (R1). It is evident how the state's effort has contributed to the inclusion of technological tools

in education. This shows the positive results of the Digital Republic program, with which the interviewees agree.

Concerning inclusion, the third interviewee comments, "Inclusion in the Dominican Republic, although there is a law (Law 5-13) and poor regulations in this regard, is at a minimum level of implementation, as is special education in the country" (R3). It can be inferred that despite the distribution of technological equipment, it does not guarantee that it is a mechanism for inclusion. For this reason, the second interview highlights "On the other hand, CONADIS promotes that the institution has accessible information for disabled people, through laws and standards to achieve the objectives of ICT inclusion that various institutions in the country are promoting" (R2). It is interesting to note that in the country there is a body in charge of dictating the guidelines for inclusion. However, it is not possible to observe a control mechanism for the various laws that are available to educational institutions. In this same line of thought, it is essential to highlight the recent report of the United Nations (2016) which highlights that, for Latin America and the Caribbean, policy commitments are maintained in the areas of access and infrastructure, the digital economy, e-government, sustainable development and inclusion, and governance (United Nations, 2016, p. 9).

Conclusions

This study shows that the Dominican Republic is aware of the importance of ICTs and their implementation in the education system and society in general. In order to achieve this, the government and private institutions have drawn up a series of guidelines that are close to those that Marchesi, Blanco, and Hernández (2014) consider fundamental for achieving inclusive education systems:

1) Increase the coverage and improve the quality of early childhood education provided to the most vulnerable groups. Ensure timely progression and universal completion of early and secondary education.

2) Remove the different forms of discrimination in order to make the right to education effective.

3) Improve the quality of educational processes and learning environments to narrow gaps in access and emergence of knowledge.

4) Invest more on teachers and develop policies that integrate initial and in-service training, labor insertion and adequate working conditions.

5) Develop support systems that collaborate with schools and teachers in addressing student diversity.

6) Strengthen comprehensive social protection and promotion systems.

7) Democratize access to ICTs.

8) Increase investment and make public spending on education more equitable.

9) Develop information systems disaggregated by factors of exclusion.

Similarly, national policies are aligned with the objectives of the digital agenda for Latin America and the Caribbean (CEPAL, 2018), in which three related to the subject matter of our work can be recognized:

1) Incorporate or strengthen the use of ICTs in education and promote the development of programs that include teacher training, new pedagogical models, the generation, adaptation and exchange of open educational resources, the management of educational institutions and educational evaluations.

2) Promote a comprehensive gender equality perspective in public policies for digital development, ensuring full access to and use of ICTs by women and girls, and fostering women's participation and leadership role in public and private decision-making forums in the digital sphere.

3) Ensure access to ICTs for vulnerable groups in order to improve their social, educational, cultural, and economic integration.

To achieve the objectives, the criterion that teachers are mere replicators, and users of ICT's must be eradicated. The fact that with the implementation of the projects, we are not focusing only on resources and infrastructure improvements. Instead there is a need to invest on teacher training, not only from the instrumental point of view, but from pedagogical dimensions and with particular emphasis on the evaluation and follow-up of training projects. This can contribute to the achievement of the proposed objectives.

This research offers the opportunity to develop studies on technological competences for people with disabilities, artificial intelligence as a learning strategy and design of mobile apps for digital inclusion

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ICT in Teaching, Learning, and Inclusion: Benefits and Difficulties in Ecuador

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Abstract

This investigation aims at shedding some light on the benefits that the application of ICTs has brought to education. As the use of digital tools has represented many challenges for the country, this research also pretends to uncover the difficulties that professors, teachers, pre-service teachers, and students may face. The approach used was qualitative and the instrument was a structured survey that sought to identify the perspectives of professionals with a wide range of experience in the field of ICTs and education in Ecuador. The research could evidence that there is a law that promotes the inclusion of ICTs in teacher´s daily practice; however, teachers lack continuity in their use. Professionals identified some positive impact of ICTs in the students´ learning process. Additionally, technological tools open space for the inclusion of students to education. On the other hand, connectivity still stagnates the process of ampler use of ICTs in education and the lack of appropriate training and hardware still represents a problem in the use of ICTs in regular classes.

Keywords: ICT, teaching and learning, inclusion, connectivity, improvement, access, training, motivation.

Introduction

The advances in technology have brought distance learning or web-based courses to an increased level of popularity. The development of platforms, apps, and many other technological tools are offered around the world through the Internet. These courses have benefited a lot of students, but mainly those who are constrained by distance or time (Chang, Wu, Chiu & Wen-Ching, 2003). Tomczyk and Oyelere (2019) bring positive feedback on the inclusion of people in education. However, designing and implementing such tools and platforms represent a serious work to be taken in the field of education as every single activity designed embodies not only time but critical reasoning regarding the outcomes expected from students. This brings to mind the term of digital literacy.

Digital literacy represents an ability to use information and communication technologies to assess, create, and convey information. These processes require cognitive and technical skills. Spires and Barlett (2012) divide these processes into three categories: "a) locating and consuming digital content, b) creating digital content, and c) communicating digital content. Critical thinking is a transversal skill to all three aspects.

The first process refers to effective web search skills, which should be reflected on proper incorporation with the teaching practice. According to Pérez-Tomero and Varis (2012), digital education sets out the didactic, pedagogical concerns, and knowledge regarding digital tools. Moravei et al, (2011) mention domain knowledge, use of search engines, literacy skills knowledge regarding resources in the web, knowledge about web search terms as examples of web search skills. However, an extensive knowledge regarding the variety of tools offered on the web is also desirable to guarantee a match between a good teaching practice and a good learning process.

About the second process, digital resources take time to be developed, but they free up teachers as they do not necessarily have to lecture or grade. However, mastering how to develop or use web tools is a must to engage students in their learning process so that students don't spend time in learning how to work with a digital tool, but focus on what is necessary to learn. This part may often represent a challenge to teachers, even when the creation of digital content or tools are becoming simple since this simplicity demands teachers to reach every single student (Spires, Medlock, & Kerkhof, 2018). The third process refers to the understanding of how to manipulate information in multiple digital forms. As the internet is so popular these days, it has become a great source of information. However, there is a need to know what information is

reliable in this endless digital world and how students can synthesize the information provided so that their learning process is enriched.

To some teachers, developing these skills may lead to frustration. Technology indeed offers potential to teachers in their instructions, but it may also be overwhelming as they need to find ways to overcome the many challenges that the use of technology brings, especially if their background lacks preparation in this field.

Purcell, Heaps, Buchanan, & Friederich (2013) state in their study that "internet and other digital tools have added new demands" (p. 2) to the teachers´ lives. They have also increased their need to know about content and skills in digital terms and have had an impact in their work. In their study, the researchers mention three main problems that teachers face when working with digital tools: training, support, and access. Concerning preparation, they mention that education technology is constraining if the schools do not have fast internet connection or enough number of computers. Regarding training, the researchers consider that this aspect needs to be adequate to help teachers use technological tools to the most. Finally, they consider that the lack of technical or administrative support can also become a barrier when teachers start using digital tools.

Ecuadorian sample characteristics

The study was carried out between December 2019 and February 2020. The sample was purposefully chosen to attain the objective of this study. The three participants are well-known professionals in the area of virtual communication, education, and the teaching of English not only in Ecuador, but in Latin America. The first two respondents are full time professors in a private university. The third respondent represents an editorial from a famous university that publishes books and materials to teach English.

The first respondent (R1) has a background in teaching English in several places that range from schools to colleges and universities. He has sparkled the use of technology in the teaching of English not only in Cuenca, the city he lives in, but all over the country. He designs and teaches modules in universities and in pre-service teacher´s programs aimed at encouraging blended learning and the use of platforms like Moodle to motivate future teachers to apply principles of blended learning and break the barriers that digital literacy may bring to their minds.

The second respondent, (R2) is the director of the Open University Department, which is the department in charge of all virtual programs created in the university. This professional is in charge of opening and

developing courses in Moodle mainly applied to social and arts subjects. He has been in charge of this position for about seven years and has led several distance programs aimed at students from different parts of the country. One thing that is worth mentioning in his background is that under his leading, those distance courses have shown a very low number of dropouts, which is an aspect he finds challenging given the situation that this type of programs have in our country. He established the first team in Ecuador to set up the basis of virtual education and the use of social media in 2007 as well as a program to train professors in different areas of the country. He has significant experience in the creation of virtual classes in universities from Spain and Ecuador.

The third respondent (R3) is a Key Account Manager of an international university editorial team. He also holds the position of digital coordinator in Ecuador and the north part of Latin America. He started as a digital specialist in the editorial and has been in charge of platforms and digital tools aimed at teaching English for nine years. He has also worked in the academic field in conjunction with the digital area of teaching. He is currently developing training programs for TEFL (Teaching English as a Foreign Language) teachers all over Ecuador to support their job and encourage them to go over the technological barriers that the use of ICTs may bring. He is developing courses in digital media to reach teachers in different areas and work collaboratively through the use of ICTs.

Methodology and data collection tool

This qualitative research gathered information in the form of open-ended questions by means of personal structured interviews. As literature states, interviews are a commonly used form of qualitative research; furthermore, it is less concerned in generalizability and it focuses on fewer participants as is the case of this research (MacKey and Gass, 2011).

The interviews were carried out face to face and lasted between fifty and sixty minutes. In order to keep ethical protocols, all participants were asked for the proper consent to have their interviews recorded. Also, they were informed that they could withdraw at any moment from the interview and their identity and anonymity were guaranteed since their names were kept anonymous. The interviews were in Spanish and then translated and transcribed into English. After the transcription was done, it was reviewed by the Language department academic board of the University of Azuay to reinforce the validity and accuracy of the transcript.

As Creswell (2014) suggests, not all the information gathered can be used since it is rich and dense in content. Therefore, the data was condensed into relevant themes by a process of coding, and some parts were

not used. The questionnaire was devised to gather general information about the participants but mainly it was focused on the use of ICTs, its inclusion in the teaching process, the main obstacles in using ICTs, as well as its strengths or limitations, the use of ICTs in vulnerable or disfavored groups, among others. The set of questions used in the interview are presented in Annex 1.

Results

In this part, the findings are summarized and condensed by themes as follows.

Lack of continuity in the use of ICTs and technology

One recurrent concern was the aspect of continuity on the use of ICTs by the teachers. The interviewees expressed that there is still a common denominator by teachers and that is the resistance to continuously use technology and ICTs. Their main impressions reflect the fact that if there is any use of ICTs it is minimal and the perception of the use of tools such as virtual campuses are merely to upload documents so students can download later. The participants' opinions are presented.

"There was a study in the university and it was concluded that the Language department and the Engineering faculty were the ones that most tend to use ICTs in the form of a virtual platform. About a year ago, I made an analysis on the use of the virtual campus of all the courses and between 50 to 60 percent of the cases the virtual campus was only used as a repository and there was still not a clear perception that the use of the campus needs to be updated and framed as a teaching tool with the necessary instructions, deadlines for homework, etc. Nevertheless, I want to be positive on that regard since I see that some people are slowly starting to upload learning tools in the Moodle platform which before were nonexistent". (R1)

"Many teachers are not willing to use technology, even though they may use technology, as in the case of smartphones, they still have a big resistance in trying to include technology within the classroom. I think that it is mainly out of fear, fear of ridicule since the teacher may not feel safe or in control to confront his/her use of technology with the students. Therefore, some teachers are not willing to implement a technological tool in their classes. It could also be a generational issue instead of the age factor" (R2).

"The teachers need to start creating their own learning instruments, but they are not taking advantage of ICTs to create their own instruments

since they are not using the tools such as a virtual campus to its fullest. They may know how to create a campus but only as a repository but they are still lacking in understanding the technologies to make the change and create their own instruments to generate the interaction in the classroom. In most cases, teachers only use a virtual campus just to upload a file so students can download it and that is it. Therefore, I consider that it is important to train teachers for them to continuously use ICTs, this way they will open their eyes to the possibilities that technology has to offer" (R2).

"According to my own experience, one of the main factors for the lack of continuity or even implementation of ICTs from teachers is that they do not want to leave their comfort zone and so a teacher feels afraid or it has some sort of rejection to explore and implement new fields such as technology and ICTs. Another problem, for this segment of teachers, also known as digital immigrants (generational factor), is that if they decide to use ICTs they do so but very succinctly. For example, in the case of using a virtual platform, the teachers sometimes limit themselves to use ICTs just to send an assignment and that's it. This could be due to two reasons: lack of knowledge and motivation to use ICTs" (R3).

An important consideration is worth mentioning is practice makes it perfect. Teachers need to understand that the road to learn and successfully apply ICTs in their classes requires commitment and constant practice as one interviewee mentions:

"Also if a teacher is not constantly using technology it is very easy to forget something he/she once learned. For example, if a teacher learns how to create a blog today but then he doesn't continue using it and enriching it with material or reviewing and coming back to it, he/she will most likely forget about it. So practice and continuity are key when it comes to properly learn about ICTs. Finally, a teacher should become aware that the use of ICTs is part of their teaching process in their daily lives and as such, they should use it constantly" (R3).

The preceding findings and opinions concur with a recent study on teachers' attitudes and perceptions towards the introduction of ICTs in Ecuadorian public schools as conducted by Alvarado, Aragón, and Bretones (2020). After interviewing fifty-six teachers from several public schools in the city of Guayaquil, the researchers found that all participants reported feelings of fear of technological change due to the implementation of ICTs.

Impact on students' improvement by using ICTs

All the participants agreed on the fact that the correct and guided use of ICTs brings more benefits than trouble, and if any problem shall arise, it could be easily corrected if the teacher is knowledgeable enough in the use of technology. Their own words are listed below:

"In my own experience there is definitely an improvement in students' progress as long as it is linked to previous planning of a class, not only implementing a technological tool is important, but planning its use is key. For example, planning the formative and summative evaluation which at the end provides parameters to show the improvement of the students is a must. Regarding how much a group actually improves, I once had a control group study, and the group that didn't use ICTs maintained their scores but the group that used ICTs had an improvement in a percentage of around 70%, which was really high. Nevertheless, those who didn't use ICTs at all depended on the old methodology by using only books and they didn't have the necessary motivation if they had had a motivated teacher perhaps they could have also improved their scores" (R1).

"The use of ICTs has a positive impact on students' results. The teacher needs to understand that teaching tools are not only limited to the virtual campus but also that the students already live in a digital world that is full of social networking. On one side a student could use the virtual campus but they also have a myriad of social networks and a teacher should start thinking about fitting within that context as well. In fact, I think that a student will give its best if he/she is not only graded within the classroom, but their work is also exposed to their friends and the whole world if they upload their work on social networks for everyone to see. As an anecdote, in one of my classes, I teach Design History and I asked my students to create a community blog so they can contact and interview Latin-American designers, the students also created a video to be posted on social networks and with that they felt rewarder since their names appear in the blog and are in front of the whole world, thus giving them a sense of recognition" (R2).

"If an ICT program is implemented correctly it certainly presents more advantages than disadvantages. Mostly I see more chances of impacting positively our students by using ICTs. Nowadays, since everything revolves around technology and everything is interconnected, and students are not aliens to technology, the use of ICTs in the class is a way of promoting engagement and interest. One of the main characteristics of using ICTs is that the teacher can take the knowledge from the classroom to the students' home, not in the way of transporting it but extending it, which means that the learning process does not end when the day

at school is over but it goes beyond and the students have the chance to continue digging and learning at home. By doing so, this translates in giving students access to information no matter where they are" (R3).

An important consideration arose in one of the interviews, and that was the subject of interaction. Certainly one cannot expect to have the necessary attention and engagement from the students if the class does not include elements of interaction such as forums, chats, surveys, games, etc.

"The impact on students' improvement will also depend on the level of interaction with the students. Using ICTs by focusing on the interactive factor is key not only to students' improvement but for their engagement and motivation during a class" (R3).

Connectivity and access to ICT in education in Ecuador

In a study carried out in Ecuador by Valdivieso and Gonzáles (2016), they mention that there is a gap in education between private and public schools regarding ICTs. Teachers working in private schools integrate digital tools more frequently than those working in public schools for many reasons, one of them is connectivity. Private schools invest more money in access to the internet; parents have better incomes and invest more in hardware for their kids. All three respondents concur with this study as the three of them mention that in their experience connectivity is a major problem especially in remote areas of the country, not only for professors and teachers but also for students.

"Basically, the obstacles that are present in the use of ICTs, is poor connectivity, which happens all over the country. Today it is common to talk about the BYOD, which means bring your own device. The MALL is very common. It is mobile-assisted language learning. For the first one, students have to bring their own electronic devices to class and many times, students can't afford to do it, so the solution is to provide students with the material..., but it is an obstacle in the case of bringing your own device, it is all responsibility of the student, and the one who can´t afford it, well, it is on him to find a solution. That is a real obstacle. This lack of equity when students need to have their own hardware is one of the highest problems in the country" (R.3).

This problem also may arise among disadvantaged groups. However, ICTs itself can provide a solution to these disadvantageous groups. The person in charge of developing programs to teach English in Ecuador mentioned that in a study he carried out among persons deprived of their

liberty, he was able to find that although connectivity was restricted, the use of ICTs to teach English was successful.

"if in the center there were ten computers for two thousand prisoners, the whole program would have flunked as there were not enough computers for all of them, the same would have happened for internet connectivity. However, the program in teaching English to this group of persons was successful because those taking the course had their own devices. Although connectivity was restricted, it was enough for the course" (R.1).

To the third respondent, access to ICTs rounds up all problems related to the use of ICTs in education. Connectivity is a portion of it. Special efforts should be made to ensure equity of access in all parts of the country to ensure a proper application of ICTs in education. By access, he does not mean only connectivity, but ICT networks and equal opportunities to acquire skills to find information by using ICTs.

"Teachers and professors are studying courses to learn about how to use ICTs. However, the courses should aim at how to use ICTs correctly in their classrooms, and that teach them to take the risk to use ICTs, with the passing of the days the use of the ICTS in the classes will improve and the professors and teachers will become more confident in the use of the tools in-class time. Now most teachers use platforms like Moodle to save files and do not know how to exploit the tool to the full. This is because they lack proper training on how to access different tools and because there should be more investigation about the results obtained. We learn more with practice. We need to teach our teachers that they can work independently and by themselves, so we need people who can teach this to our teachers" (R.3).

Inclusion and ICTs

In 2010, the Higher Education Act (LOES, as per its Spanish acronym), was created and aimed at pushing universities and colleges to make use of digital platforms to improve education and research with special emphasis on the inclusion of students with special needs and different learning styles. In this way, aspects such as interactivity, the relationship between students and professors, and access to information are fostered in all universities in the country. This meant that professors had to be trained in using ICTs in their classes. Additionally, pre-service teachers had to be trained in how to use and develop creative courses by using ICTs. In 2009, the National Plan for Well-Being was launched and aimed at creating a new economic paradigm that sought equal distribution of wealth, a new type of relationship between man and nature, and a pur-

suit of social justice. To reach these goals, the plan demands the democratization to free access to water, land, loan, technology, and information. This plan takes higher education as the main aspect to reach good living conditions. It linked higher education and research, tied with technology. Thus, the country should guarantee access to all citizens to higher education as a way to increase the productivity of the country. The plan considers the use of ICTs as a way to foster interculturality. Thus, this plan goes further, as it requests all institutions in the education field not to count only with cutting-edge computers, but to teach students to generate tools that aim at hold the transformation of the country (Consejo Nacional de Planificación, 2009).

"The problem is that our major does not prepare us to work with children or elders. Instead, it is a general education that we receive. We are taught to teach everyone, but not to to one specific area of the population. Thus, if pre-service teachers receive any type of formation in this aspect, they are studying how to implement the use of ICTs in their syllabus, but they do not receive any formation aimed at disadvantaged groups. Thus a government policy is mandatory to create a law to first protect this group of people, and second to create computer centers aimed at teaching these people" (R.1).

"In one of the courses I taught, one question arose regarding how I could dare to implement digital tools in schools with low income. It was complex for me and I understood the point teachers had. However, they were unaware that currently, all students have a technological device that can use not only for communication but to learn as well. Thus as a teacher, you won't have to ask your students to buy expensive products, but you can teach them how to work with what they already have" (R.2).

The use of ICTs also represents knowing the other, knowing who my students are and what their interests are. This also represents an obstacle in the use of ICTs in education as they may seem like it is the simple application of a tool and that problems in education will vanish as if we were using a wand. Unfortunately, the use of ICTs requires a lot of critical thinking and the application of otherness to get the most of them.

"We need to know who our students are before we design any course or use ICTs in our classes. It is a human theme that is key in the use of ICTs. Once I know who my students are I can design properly, so it is not a matter of thinking generally about a level 1 as a whole, thinking in the students as persons" (R.1).

In education, there is a term named hidden curriculum, which according to Jung (2015) refers unspoken rules, social values, attitudes, and

norms that govern behaviors in various situations" (p. 141). Thus there are certain rules and forms of acting that show that inclusion criteria or laws set by the government are not being followed. An institution can offer access ramps, but omit changes in the curricula, minority groups and disabled people are still being ignored.

To the professional in charge of developing programs in virtual platforms, colleges, in general, do not have open access to education, especially to those disadvantaged groups.

"Many people don't study because they cannot attend classes in colleges. Distance education should be the alternative. The same principle could work for minority groups. However, universities do not worry about them. For instance, if a blind student logs in the university´s platform, he won't get much as he won't be able to read what is in there. Not all tools offered are accessible to all students. Universities are not meeting accessibility standards for disabled people. MOOCs are a solution to reach wider audiences of students, but still, they have not been designed for disadvantageous groups. I think first there should be correct planning to develop courses aimed at minority groups, oriented exclusively to them. Not only courses aimed at everyone with one particular feature for disabled students" (R.2).

Hardware and training in education

According to Reina (2012), permanent training on the use of technologies in and out of the classroom is fundamental. Such training should be developed in two stages: the first on the relationship between the teacher and the student and the second one is more about a follow up on how the ICTs are used. This involves pedagogical concepts about the learning environment and how technological tools can corroborate with them.

According to the interviewers, this is the aspect that colleges lack in their curriculums

"The training should consist in two parts. First, how to use ICTs in class as part of the curriculum instructions in colleges and a second moment aimed at teaching pre-service teachers how disabled people learn. In this way, future teachers can learn how to get the most of ICTs to benefit disadvantaged groups" (R3).

Flipped classrooms may represent a good opportunity to show off the use of ICTs in education, as the expert in the use of ICTs applied in teaching English states.

"Technology is here to help teachers in their practice, not to generalize. It is all the way around; technological tools were created to personalize teaching according to the different learning paces" (R1).

The teacher needs to have a clear vision of what a flipped classroom is so that he chooses the best material for that. It is not about telling the student what they are going to learn the day after and leave every material in free access so that the student learns, if so, it is enough with sending students a questionnaire of things to be ready for a test. A guide is basic.... Flipped classrooms are one of the tendencies that are growing in popularity each time more. I wish it is well implemented in all institutions through good training in this area. There are people with a wide range of knowledge in the area. The lack of training, however, has turned the use of ICTs classrooms into a complementary tool, when all it has a wider choice of use to help students to pass a course. In certain institutions, a platform can be used only up to 10%. From here, this vicious circle starts again. There is little attention of the teacher and a short interaction with ICT tools as well" (R.3).

The training that pre-service teachers receive in ICTs is scarce in terms of the use. Pre-service teachers learn to work with ICTs but as students not as teachers. This also reflects the lack of training in this field in colleges and universities.

Pre-service teachers learn about ICTs as students. There are only a few majors, actually, the recently-created majors are implementing the use of these technological tools as part of their instructions. One part of the curriculum focuses on teaching students to handle ICTs in classes, but it is still very scarce. Pre-service teachers know about these tools as students not as administrators. However, the need is pushing colleges to increase this training (R.2).

Training is a lifelong learning process, therefore, as teachers, we should always look for paths to find new access to new theories in pedagogy and tools that can be applied in technology. "The recommendation is first never to stop learning, always look for more training and course, more methods and access to all kinds of resources." (R3).

"Constant education is the key. As education is not exclusive to one single group of students, teachers should be eager to keep learning and updating their knowledge in the field of technology. The only way to learn about a tool is by using it, by getting to know the most of it" (R1).

In a recent study carried out by Balladares-Burgos (2018), it was found that there is a high interest in training pre-service teachers in the

digital world in Ecuador. Most universities are developing programs with specific curriculums that may help future teachers apply technology in their classrooms. Nevertheless, this implementation requires attendance to workshops, and informal and non-formal space to learn about how to use ICTs in a class by different means of communication.

"Teachers here know about some mechanic aspects of ICTs, but they do not actually belong to a community of practice. Teachers mostly use ICT for communication rather than education itself. This is precisely where the lack of training can be seen" (R.1).

"Teachers and professors should create leaning nets. That is the best way to learn about ICTs because I set goals and then I try to reach them. Then I share them with my group or net and expand the chances to grow technologically" (R.2).

The director of the Open University Department, this aspect also depends on the background that people have. Less education means less ability to adapt to technological changes. He does not agree with the fact that age can be a limiting factor.

"Education and technology depend on the level of schooling rather than age. If a person has not graduated from high school, adapting to technological changes is harder. I have had students who are not that young but have been able to catch up with these changes. People who haven't used technology in their schools, in the 1980s more or less may also find it difficult to use tools to teach" (R.2).

The digital coordinator of the editorial considers that lots of effort have been put on the training, but the quality is an aspect that needs to be improved.

"Probably the training that teachers and pre-service teachers have received is enough, but not efficient. Today there are a lot of free programs that train teachers, but they may lack quality. They do not aim in the use of the tools. If you ask a teacher that has taken some of the workshops whether a tool offers synchronous or asynchronous work and they won't be able to know. This happens because training tends to be shallow... The training show take into account the specific needs of the teachers" (R. 3).

Attitudes and use of ICTs in education

Meaningful use of technological tools in education can be influenced by the attitudes that teachers and professors can have towards the use of ICTs. Teacher´s attitudes constitute the major predictor in the use of new technologies (Edmunds, Thorpe & Grainn, 2012). The attitudes that teachers and professors have affected the use of technologies in the classroom. The attitude that professionals have furthers or hinters the amount of technology used in class because attitudes determine the reaction of teachers. It is this positive or negative reaction that encourages or diminishes the use of technological tools. For some teachers, ICTs can be scary, while for others it can be challenging and even rewarding. This aspect is something that is mentioned in all three participants of the study.

To all the interviewed respondents, attitude is a key factor that can favor or discourage the use of computers or any technological device. The simple fact of having to work with a mobile phone can be a barrier to some teachers and students, while for others is just a mechanical step.

In his experience respondent 2 expressed in this topic that "for a group of students in a course that I had, it was negative to work with the android, but at the moment of working with a computer it was simpler, even when they knew that the android had better characteristics than the computer and had better software to do certain things" (R.2).

To this interviewee, all physical disadvantages can be reduced with a positive attitude and wanting to work with technological tools. He happily recalls a group of students in one of his training programs where there were a lot of older participants. Some of them were just about to retire. It was a diploma course that opened with the purpose of setting the basis for teaching online. There were also indigenous people who lived in remote areas of Manabí, which is located in the coastal region of the country, far from the city where this professional works. He said:

"Although they did not have access to the internet, they had to travel to another town to go to a café net and be able to have connectivity. In spite of the limitations, most of them finished the course meeting the highest expectations, just because they were motivated" (R.2).

To the third interviewee, the lack of proper application of ICTs in education is a double-sided problem. On the one hand, there is a comfort zone that teachers may be afraid to leave aside. They might feel that they lose control and even won't be able to predict factors that can happen

regularly in a traditional class. Although ICTs can help them improve their teaching practice, they do not prefer to move to a risk zone.

"The use of ICTs depends on the interest that teachers have on using technological tools in their classes. As a teacher (interviewee, in reference to other teachers) I am used to what I have, so I am reluctant to explore new paths, which includes the digital forms. Additionally, it can also happen that as teachers are forced to use digital tools in their teaching practices, they do it only in a shallow manner. They just use the tool to exploit the general features such as communication, and sometimes they even skip this, such as when the teachers tell their students, during their face-to-face classes, they have to do an assignment. The teacher only closes the activity or sets a deadline, or to get the grades. The use of ICTs is then limited to these simple boundaries" (R.2).

Another aspect mentioned in this category is that excitement can also create problems in the use of digital tools. As the first interviewee said,

"If a teacher learns about a tool and gets excited on how to use it, this excitement can take the teacher to the use of the tool without accurate planning, just because the tool shows great potential, the results won't be positive" (R.1).

Conclusions

In conclusion, the law establishes the use of ICTs in colleges and schools, it also requests professors and teachers to use them in their classes. However, connectivity and the scarce preparation on how to apply ICTs in the classes for disadvantaged groups represent still an inconvenience. In Ecuador, teachers still need to develop skills that ease the creation of learning environments to enhance the development of cognitive, social, and critical skills in their students through the use of digital tools. The curriculums for basic, elementary, and high schools have already been developed by the national government, so what teachers need to do is create the digital spaces to further develop the skills mentioned before. Training is offered now more than ever, but it should focus on two aspects, to focus on specific needs teachers have and to ignite a spark to promote lifelong learning skills. One important aspect is the attitude that teachers have about the use of ICT. It was evidenced in the interviews that too much excitement and too much disdain can affect the expected goals in education. Thus, training should also reinforce these emotional aspects, so that teachers find the use of ICTs challenging and yet rewarding. A recurrent comment was also the motivational factor. It is necessary to change the paradigm of "regular" classes and start aiming for a "new" approach in teaching according to the ever-changing world

in which education plays a major role. Technology and ICTs is not the future, on the contrary, it is right here right now, it is time for teachers to leave their comfort zones, explore, dream, and learn the infinite opportunities presented by technology, and after all, one cannot be an analog player in a digital world.

ICTs are here and they are opening a wide range of opportunities in education. Thus, training aimed at teachers should focus on their use and the experiences that teachers can have regarding each tool that is used in class. That is, educational policies should aim at fostering communities of practice rather than training on a specific tool so that a real collaborative approach can be practiced in the ICTs-education world.

Through the collaborative approach, teachers can become committed to the use of ICTs as the sharing of experiences with their peers and thus support real ICT use for teaching. Besides, ICTs may hold surprises to some naïve teachers and that is precisely the moment when support is needed to encourage the use of technological tools in class.

All three respondents reckon that the proper use of ICTs is a great opportunity in education as it defeats educational barriers and it promotes immersion in different fields. They awaken curiosity from students to further participate in the elaboration of their class material. ICTs also ignite a spark in students to explore new media tools to share knowledge so that they can expose the products of their learning work with their contemporaries.

Given the much positive impact that ICTs have on education and that the drawbacks of their use are manageable in our country, the question stands on to what prevents our educational system from fully taking advantage of them?

FINDINGS SUMMARY						
	Lack of continuity in the use of ICTs and technology	Impact on students improvement by using ICTs	Connectivity and access to ICT in education in Ecuador	Inclusion and ICTs	Hardware and training in education	Attitudes and use of ICTs in education
(R1)	I made an analysis on the use of the virtual campus of all the courses and between 50 to 60 percent of the cases the virtual campus was only used as a repository and there is still not a clear perception that the use of the campus needs to be updated and framed as a teaching tool with the necessary instructions, deadlines for homework etc.	Improvement on students' progress as long as it is linked to previous planning of a class, not only implementing a technological tool per say but planning its use beforehand starting with formative and summative evaluation which at the end provides parameters to show the improvement of the students.	Having devices is important to assure the programs becomes successful	In applying technology in education, several principle s of otherness and empathy are necessary	Technology is important to mark a different pace in the teaching process	Good planning is relevant to the application of ICTs in education
(R2)	Many teachers are not willing to use technology, even though they may use technology, as in the case of smartphones, they still have a big resistance in trying to include technology within the classroom. I consider that it is important to train teachers in order for them to continuously use ICTs, this way they will open their eyes to the possibilities that technology has to offer.	The use of ICTs has a positive impact on students' results. The teacher needs to understand that teaching tools are not only limited to the virtual campus but also that the students already live in a digital world which is full of social networking.		Socie-economic factor may interfere in the application of ICTs, but not always.	It is important to train teachers to use ICTs as teachers not as students.	Remaining in the comfort zone does not bring positive effect on ICTs in education

(R3)	According to my own experience one of the main factors for the lack of continuity or even implementation of ICTs from teachers is that they do not want to leave their comfort zone and so a teacher feels afraid or it has some sort of rejection to explore and implement new fields such as technology and ICTs. Also if a teacher is not constantly using technology it is very easy to forget something he/she once learned. Finally, a teacher should become aware that the use of ICTs is part of their teaching process in their daily lives and as such they should use it constantly.	If an ICT program is implemented correctly it certainly presents more advantages that disadvantages. Mostly I see more chances of impacting positively our students by using ICTs. Aspects such as engagement and interest of the students since everything nowadays revolves around technology and everything is interconnected. The impact on students' improvement will also depend on the level of interaction with the students.	In Ecuador, there are still problems with connectivity. That affects the use of technology in education		Pre-service teachers need to be trained on how disabled people learn	

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The role of ICT and its pedagogical contributions in Finnish education: Advances in educational innovation for inclusion and technological literacy from the perspective of stakeholders

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Abstract

This chapter investigates the role of ICT (by which we refer to technologies such as software and hardware solution in general) as a pedagogical support tool in the Finnish education sphere. Qualitative research method based on interview was conducted with four (4) experts whose background varied from education to ICT. The result of the content analysis indicated that the use of ICT in Finnish education is widely spread and some of the respondents have cautious attitudes in adapting ICT as a part of their profession. Besides, this study identifies that the greatest barrier to implement ICT based solutions in schools are the funds. Based on the interviews and researches presented previously we conclude that digital literacy among the teachers in Finland is high as in many knowledge societies in general. Based on the interviews, also the use of ICT based innovations in schools in increasing in Finland.

Keyword: ICT, Finnish education, Inclusion.

Introduction

The use of ICT in Finnish education system is widely spread from elementary schools to the institutes of higher education (Niemi, Kynäslahti & Vahtivuori-Hänninen, 2013). Both hardware and software are extensively used to support learning, teaching, analysis and interventions. It is not unusual that elementary school students have iPads or Chrome books, which they use during the teaching and at home for completing the given homework (Kyllönen, 2014).. The teachers encourage students to harvest the power of ICT from early ages: the path that they will continue in adulthood as citizens of digitalized society. While this is the case in many schools and for many teachers, one should be aware that the attitudes of teachers regarding the use of ICT varies. Most enthusiastic teachers use novel innovations such as Virtual Reality (VR) and Augmented Reality (AR) as a part of teaching itself but there exist cases where teachers are not keen to adapt the ICT as a part of teaching.

The digital literacy of Finnish teachers is in general high (Zhao & Li, 2015; Tomczyk & Oyelere, 2019; Ellison, 2009). The teacher training in Finnish universities acknowledge the importance of the digital literacy and its impact on inclusion ((Lähdesmäki & Valli, 2017). Students with disabilities are yet facing another challenge: the adaptation of ICT based solutions is well spread to general education. However, the lack of proper materials, applications and hardware can cause exclusion among the disadvantaged (Haukipuro, Shabalina, & Ylianttila, 2015).

The rise of ICT use in the education in Finland has gained a boost due to the governmental acts when programming and computational thinking became a mandatory part of the curriculum (Bocconi, Chioccariello, Dettori, Ferrari, Engelhardt, Kampylis, & Punie, 2016). However, integrating ICT such as computational thinking and programming into the curriculum is done through teaching them as a minor subject of mathematics and such; not to teach them as standalone subjects. Such acts created a demand for proper hardware and software for the students and, of course, for the teachers. The teachers were demanded to know the basics of CT and programming and this further increased the digital literacy (Yadav, Gretter, Good, & McLean, 2017).

The government and the business sector provide funds, equipment and training for the teachers. The teachers can properly use the given software and devices as part of teaching activities. However, the funds are usually fixed and in general, only free software is being used. The teachers and the schools cannot demand the students to pay additional fees to participate in teaching. This is ruled in the constitution: the basic

education should be free and accessible for every student. Regardless of the students' background such as the financial status.

Study participants

We interviewed participants whose background varied from education to ICT. All of the subjects had experience in either working with children at some point of their professional careers. The interviews took place in March, 2020. All of the participants were living and working in a municipality of Joensuu, Finland. Joensuu is located in the Eastern Part of Finland near to Finnish Russian border.

In the following paragraphs, we introduce the participants we interviewed for the study. We introduce each participant based on the professional experience and their knowledge in education and the students. We refer the participants as S* in the following sections.

S1 was a history and social science teacher in the secondary school. S1 was native Finnish and she had been teaching social sciences and history for at least 10 years. She also taught 3D modeling and printing in the same school as she taught history and social sciences. She had a master's degree in pedagogy. In general, her attitude towards ICT as a tool to support teaching and learning was positive and she was keen to adapt innovations and novelties to support her activities in the classroom.

S2 was a social worker who worked with families and children with disadvantaged backgrounds. Mostly her clients involved children whose parents or guardians had been affected with conditions such as mental illnesses or alcoholism. She had a master's degree in social sciences and social work from Finland. However, she did not have pedagogical background and her knowledge in ICT was at intermediate level.

S3 was a social worker, who also worked with families and children who had challenges in upbringing and everyday activities. S2 and S3 worked both for a city of Joensuu, a municipality located in Eastern Finland near to Finnish Russian border. As S2, S3 did not have a degree in pedagogy but instead a degree in social sciences and social work. In Finland, a law enforces a social worker to hold a master's degree in social work in order to be qualified to work with children and families. Her knowledge in ICT was also at intermediate level.

S4 was a software engineer in Joensuu, Finland. He holds a master's degree in computer science from the University of Eastern Finland. During his studies, he taught robotics for children in informal settings after school days. He did his master's thesis in educational robotics and

had vast knowledge in educational technology. Although he lacked a degree in pedagogy, he had years of experience in educational robotics, which was also his PhD thesis' topic.

In general, all of the participants had experience in working with children with various backgrounds. Half of the participants were very familiar with technology and used ICT every day. The remaining half however did not use much ICT as a part of their professions (S2 and S3). Also, their attitudes towards ICT varied. S1 and S4 had positive attitudes towards ICT in education while S2 and S3 shunned ICT to some extent.

Ethical concerns

We interviewed in total 4 participants who had experience in working with children. The anonymity of children was not compromised under any circumstances: the participants of the research conducted did not describe or name any particular child or a student to the extent where the child or a student could be identified by the researchers or the readers. For those children who were counseled by a social workers, no any kind of description of any child was given. S1 described some students but did not provide names or age; only origin and gender.

Results

Implementation of ICT in schools and other educational institutes

The use of ICT in Finnish education is widely spread. S1 stated that all schools in Joensuu area provide hardware to at least secondary school students. Most of the schools provide iPads, which are owned by the school, but the students have an opportunity to purchase the devices after the graduation. The remaining schools provide Chrome books with the same option for the students to purchase the device after the graduation. The same applies for the teachers. All teachers in Joensuu area are provided some sort of device: a tablet computer or a laptop for instance. Most of the classrooms are equipped with Smart Boards or similar intelligent blackboards and Apple TVs. The teachers use extensively mobile devices and the support comes from the city of Joensuu, which receives funds from the government ultimately. The city also provides additional materials such as 3D printers and introductory courses for the devices that the teachers are provided. However, according to S1, the city does not provide education in hardware of software use for the students. The attitude is clear: the teachers are given education, which they are supposed to continue in the classrooms.

According to S1, she and many other teachers tend to experience with different software, which might be used to support the learning and teaching. The constraint is that the software must be free: the city does not provide licenses for software packages excluding the basic applications such as Office 365, which contains Word, Excel and PowerPoint for instance. Also, the teachers cannot demand the students to pay additional fees and this is forbidden by the law: in Finland, all public education must be free and inclusive. Paying for a software that is required to learn can be exclusive and selective in a favor of children who are more advantaged.

In Joensuu... mostly Chrome books or iPads: Joensuu provides these for all secondary school students for free. They are able to purchase the machine after they graduate so actually the school owns the machines during their studies. We also have licenses for Microsoft products such as Word and PowerPoint. iPads are really great, and the students know how to use them (S1)

S4 worked with primary school children in after school club where the children assembled and programmed educational robots from Lego Mindstorm series and Arduinos. The club was not free of charge, but all children received the same robotics kits. S4 stated that the origins of the club were more than 10 years from now and the philosophy had been the same ever since. According to S4, the educational robots are widely used as a part of curriculum nowadays in Finland to learn computational thinking and programming, but this was not the case 10 years ago.

S2 and S3 were more cautious with the implementation of ICT to their profession: the disadvantaged children with whom they worked with did not used ICT during the counseling. If any, S2 and S3 had negative attitudes in adapting ICT as a part of their profession.

The greatest barrier to implement ICT based solutions in schools are the funds. The city and the government provide fixed amount of funds to schools. The schools are then obligated to purchase the hardware and the software for the students. Since the amount of funds is fixed, the schools cannot request more funds for the innovations and such. According to S1:

"The funds to support ICT in education is usually the first in line when the city or the government cuts something off from the schools. It is easy for them..."

S4 noted:

"I think it's always the money. And the fact that maybe not many teachers are keen to learn to ways to teach?"

Also, S1 suggests that negative attitudes towards ICT among some teachers is a barrier to adapt the ICT in more general level. S1 states that some teachers shun ICT and cannot see the additional value of hardware and software in learning and teaching. In Finland, it is up to the teacher how and what is done in the classrooms. The teachers must follow the study plan to some extent but how the learning takes place, is completely based on teacher's decisions. If a teacher wishes not to use ICT as a part of teaching, then the ICT will not be used in his or her classrooms.

According to S1, the freedom of the teacher in Finland is an advantage and disadvantage in this sense: the teachers are not forced to follow any specific path as long as the subject is based on the study plan provided by the government. It is clear that some teachers are not as confident as others in using ICT in education. If the additional value is not seen, then ICT is not used. This applies also for the funds provided by the city and the government. In order to remove these barriers, those who are responsible for the funds and the teaching should be informed about the extra value added by the ICT.

The innovations used in schools are usual in Finland. S1 stated that 3D printers, VR, and AR are used in certain learning settings and by some teachers. Again, the funds are the greatest challenge. S1 also noted that the use of AI in the future plays a crucial role in education.

S4 stated that he doubts the innovations are widely used in schools. However, in the informal settings, the innovations in Joensuu were used as a part of education. According to S4, the trend could be seen for a decade:

"When I dealt with educational robots, they were kind of innovative. Nowadays not so much maybe? Maybe schools use 3D printers? I doubt much of the innovations are used in schools" (S4).

Based on the opinions of the participants, it is clear that according to them, the barriers in to adapt the ICT in schools apply for the innovations: the schools and the teachers were more interested in trying different innovations such as AR and VR or even AI if the city and the government would provide funds to try and experience with different innovations. For instance, the teachers can only use software as a part of teaching, which is free of charge.

S1, S2 and S3 all stated that the business sector may provide some equipment for the schools, may give discounts and gives training for the teachers who wish to use some hardware and software. The use of the human potential according to subjects is clear: the education.

"I see many bright children who have a lot of potential. Educate them to trust themselves and give them the opportunity to be innovative. That would make a huge difference" (S2).

"I mean, people should not be afraid of technology. That is the most important thing. Teachers should be aware of the advantages of technology: basic skills. I don't want to teach the students some specific software. I want to teach the students how to use email in general. Or word. On the other hand, some applications are better for some tasks and some are better for other tasks. But really, we should show to all teachers that technology can be a great partner if you don't use it too much. In that way, teachers should not be afraid to fail" (S1).

Feedback and analytics – for groups requiring support

All of the subjects (S1, S2, S3 and S4) stressed the importance of education on how to support ICT related skills such as digital literacy of those who are responsible of education. S3:

"Educate them to use the technology. Give them the courage to fail and try again. There is a difference in educating children in need and supporting them when the situation is volatile. In the latter case I would not definitely think about ICT. In the previous case ICT can be used".

And S4:

"We should give training. So they can teach the students. Not every teacher knows how to use iPads not to mention how to do programming..."

Clearly, the education should take place even before the graduation: in Finland, all of the teachers are required to obtain at least Bachelor's degree in pedagogy. Most of the teaching positions require master's degree in education or related subjects. The digitalized society has a demand that its citizens should know how to use technology and that its citizens should not be afraid of technology. S2 stated that

"...If I speak based on my experience; I shun little bit using ICT with my clients..."

According to S1, schools in Joensuu use extensively open educational resources (OERs):

"We use a lot of those. For people with poor sight, there should be more audio books for instance. For inclusion I mean. I have one student who speaks Persian language, and he communicates with me in English, but the teaching is in Finnish. So potentially more diverse collection of different languages... Most that we use are in Finnish and not even in audio. Although I should stress that in Finland, we have these special classes who are taught by teachers with a special degree. So, I don't teach that much classes for students with severe disabilities. Some, but the conditions are not severe".

S1 also stated that OERs can be used to support students with disabilities. However, in Finland, students with severe disabilities are being taught in special education classes. Teachers teaching in such classes are required to possess a master's degree in special education. Some parts of the degree overlap with a regular teacher training degree but mostly the education is more focused on different kind of learning strategies and disabilities and how to support students.

Other subjects (S2, S3, and S4) did not have experience in OERs.

All of the subjects agreed that the governmental agencies should provide more funds for ICT to support inclusion:

"Money. Government gives money. Joensuu gives money. And training for hardware and applications. But of course, if we are tight on money, then technology is the first thing that suffers" (S1).

"The funds they provide. The public schools and institutions depend on such funds. Without the funds, they would not be ICT in schools. The same applied for the inclusion: our salary comes from the city of Joensuu. The city of Joensuu raises its funds from the governmental sector and so on" (S3).

"They give money. Maybe even training? I don't know. Though they don't give as much money as needed" (S4).

Conclusions

The digital literacy among the teachers in Joensuu is high. The use of the ICT based innovations in schools is also high and increasing in Joensuu. However, the attitudes towards ICT based solutions to support

teaching, learning, analysis and interventions varies greatly between the teachers. Based on the law, Finnish (and Joensuu) schools cannot demand pupils to invest their own funds for software and hardware; the basic education in public level has to be free and inclusive for every student regardless the background of the student.

The Finnish schooling sector provides great freedom to the teacher. If the teacher wishes, ICT based solutions can be used during the classroom activities. On the other hand, if the teachers choose not to use any ICT based solution, then the students will not use any ICT. Of course, the decision is based on the teachers' own attitude and the level of digital literacy. Ottesad (Ottestad, 2010) noted in His research that Finnish teachers tend to be more conservative in the use of ICT than teachers in other Nordic countries. The attitude against ICT may be caused by one's own experiences and digital literacy. Hence, as the digitalized society evolves and its citizens use more and more different type of ICT every day, the attitudes of teachers may also evolve in favor of ICT based solutions in education; the situation when the freedom the teachers is an opportunity.

The funds are fixed but every school tends to offer their students some sort of ICT device. Whether the device is an iPad or a laptop, it will be used for the learning to some extent. Most schools in Joensuu provide the students an opportunity to purchase the device after the graduation. But this alternative is optional.

For those teachers who wished to use more software and hardware during their teaching, the fixed funds are not optimal solution. The teachers are forced to use only free software and playing with innovations such as 3D printing, AI, AR or VR tends to be difficult due the lack of such devices or software artifacts. Ellison (Ellison, 2009), however, pointed that Finnish education system is quite prone to use of innovations in general (educational innovations, for instance) due the flexibility of the system.

Informal sides of education also use ICT based solutions in Joensuu. The ICT based solutions are used for inclusion. For instance, audio books are available for the students with disabilities with hearing. For immigrants, OERs provide an option to study with their own native language.

Altogether, the schooling in Finland is inclusive and the ICT based solutions tend to increase the inclusion. The rise of novelties and innovations - if handled correctly - increase this inclusion even further.

For those who work with the severe students with severe disadvantages such as social workers, the use of ICT is not yet well spread - at least in Joensuu - but the schools, the cities and the government have woken up for the digitalization of the society.

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ICT in schools and non-formal education in Poland. Challenges of digital literacy development, modernisation of education system and digital inclusion through new media from the perspective of experts from business, education and NGO sectors

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Abstract

The text is an attempt to answer the question of how ICTs are used in the process of learning, teaching and digital inclusion in Poland. The study presents both, advantages and disadvantages of ICT implementation into Polish formal and non-formal education. Based on the data collected, the issue has been characterized from three perspectives: business, education and the third sector. The nature of the complex research problems motivated researchers to sue the qualitative study methods, expert interview technique and structured survey questionnaire as the tool. The data were analyzed using the interpretative paradigm of qualitative research, and presented respondents' experiences of implementing ICT in education. The interviewees had accumulated years of experience in introducing pedagogical innovations in Poland.

Keywords: digital inclusion, digital literacy, school, NGO, business, non-formal education, information society

Introduction

Undoubtedly, the issue of ICT in the context of educational activities has become an important area of pedagogical explorations during the last three decades. With the increasing speed and capacities of the Internet, we can observe rapidly growing number of methodology and scientific publications which refer to the opportunities paradigm in media pedagogy. The growing number of research and technical development have led to the emergence of a new subdiscipline called media education or media pedagogy. Issues related to ICT implementation to learning and teaching are now one of the priority areas of building knowledge about modern education (Potyrała, 2017).

The development of this subdiscipline poses many practical challenges which can be classified as: methodology-related, connected with the development of competencies in the information society or administrative and technical. Methodology issues address the question of introducing electronic devices to the didactic process, thus, increasing the educational added value. This question is of particular importance in the light of numerous commercial and free (e.g. OER) online applications and websites available. This is especially important for teachers of different subjects who search for attractive ICT-based solutions which are at the same time compliant with the official core curriculum. Implementation of software as a teaching tool is connected with the level of digital literacy among all the stakeholders of education system. Many myths grew around this area, for example, of the high level of digital literacy of school students (Pyżalski et al., 2019) and low level of these competencies among the teachers (Tomczyk, 2020). Both groups are heterogeneous, which means diverse styles of using digital media, different levels of vulnerability to e-threats and motivation to use hardware and software resources constructively. It is also worth to refer to the challenge of infrastructural resources. Hardware limitations are less and less important, but there are still schools which do not have broadband Internet connection or use older generation computer laboratories. Due to the above, media, digital and IT education faces many practical challenges. These challenges are global (Tomczyk et al., 2019). Many processes in both, formal (obligatory school system) and non-formal (e.g. courses organized by NGOs) education have not been thoroughly investigated and characterized, also due to the rapid changes taking place in the information society. This text aims at showing how ICT is used, in the three independent educational perspectives: formal education, business and the third sector.

Territory and Polish sample characteristics

The study was conducted in December 2019 in Poland. Three representatives of different areas connected to the education sector were interviewed: a representative of the third sector (a non-governmental organization focusing on media and digital education), a director of a large formal education institution - a school and a business person creating solutions also for schools and universities. The respondents were selected purposefully according to the sampling criteria: they are recognizable among media and IT education teachers and researchers in Poland, they possess significant didactic, research, business or organizational achievements and they possess relevant knowledge about the changes taking place in the Polish education system. Each interview lasted from 30 minutes to 1 hour. The detailed characteristics of the sample is presented below.

The first respondent (R1) is a representative of one of the biggest and most active NGOs focusing on new media education projects. As the president of this organization, she is responsible for organizing teacher trainings, for example in using computers in school. She has been in this position for 8 years and is an experienced teacher (33 years of working in school). She has diploma in primary education and is a qualified teacher of Information Technology at the lower-secondary school level. She also completed her postgraduate study in adult education and specializes in IT teaching methods, also as an academic teacher in this field.

The second interviewed person (R2) was the director of a primary school in Wielkopolska region (mid-size city). The respondent is a chartered teacher with 20 years of professional experience, with post-graduate diploma in IT teaching, trainer in several project related to multimedia education and using ICTs in school. Supervisor of students participating in national IT competitions, initiator of introducing the innovative program Szkoła Zarządzająca Wiedzą (Knowledge-Managing School) and electronic student journal (e-journal) in his school. He has a rich experience in setting up computer laboratories based on the Classmate PC technology. Organiser of cyclic conferences, seminars and workshops for teachers and education authorities, promoting modern technologies in education (three editions in 2010-2012). Awarded with many honors and awards.

The third respondent (R3) manages an IT company which operates in the commercial market since 2009. So far, he has implemented over 120 commercial projects. The respondent is also an experienced manager of scientific staff and a guest lecturer in one of the leading Polish non-public universities. At present, as visiting professor, he delivers lectures on: stra-

tegic management and IT project management but his main job is company management. He is responsible for: strategic management, resource management and IT project management. He is often a keynote speaker in the areas of: equity crowd funding, e-learning interfaces or business models. He has been dealing with ICT in education for over a decade. Given the activity in the third sector oriented towards new technologies, it is even 15 years. His business serves clients also from the education sector, for example by delivering dedicated mobile applications for universities. The respondent gave his consent to reveal the name of the institution he represents: ESCOLA S.A.

Results

Use of ICT in formal and non-formal education in Poland

According to the third sector representative, application of ICT in formal education depends on several significant factors. First, it depends on the level of education, that is, ICT advancement (and thus, digital literacy) level coexists with the metrical age of students. Teacher is the key element in this process. This situation is not homogeneous and depends on the type of school and teacher's educational background. The respondent said that people who are IT oriented are much more active in introducing attractive ways of teaching IT than the ones who teach Information Technology as the addition to their main subject.

"I think Paint laughter. Unfortunately yes, but I would bet on Paint. If we counted all hours, from the lowest grades, that is 4th grade when children have IT and slowly begin to do something there. Of course, teachers in different schools show their students what they themselves can do. The more educated IT teacher, the more they try to teach kids something. But a passive teacher or a teacher who has two hours of IT but mainly teaches sport or something else, primary education or something and has extra IT hours - they will follow curriculum which include Word, Power Point in a conventional way" (R1).

According to the school director, technical resources are the important variable in the process of using ICTs in formal education. Given the present state of development of the information society and the specifics of ICT use, the problem of Internet access becomes the starting point for further analyses. It is Internet availability that determines the use of many popular networked services, including applications to support learning and teaching, websites, blogs, communicators and social media. Changes that take place, cause certain civilizational delay of some formal education units as not all schools have high-speed Internet connection enabling effective use of ICT during all classes.

"During the last decade, this has evolved a lot. What teachers use at school, of course, depends on the concept adopted by the school. I think we all wish that Internet was actually available in schools, [thinking] I mean, that Internet access was at the acceptable level, namely according to consumer needs of the school" (R2).

ICT use differs in terms of access to websites and online resources. Teachers use the advantages of BYOD technology. With popularization of smartphones, they begin to see the potential of these devices. They try to provide students with quick access to knowledge, videos and websites using QR codes. Of course, BYOD approach is not common due to restrictions imposed on students regarding the use of electronic devices in schools.

"They use different applications. Kahoot is very popular now. QR codes are also often used. For example, I have seen the English or IT teacher coding something on YouTube and then handing students QR codes printed on stripes of paper, and they had to decipher what is there" (R1).

An important trend in Central and Eastern Europe are the changes related to the improvement of curricula in the area of algorithmic thinking and computer programming. The example of this approach are transformations of the official curricula. From the first grades of primary school students learn to create algorithmic structures which are transferred to digital space using coding environments adapted to their age.

"At present, coding is the dominating trend in Poland. I can see this development as teachers who follow this trend, learn it and try to teach others. They usually use Scratch or, less often, Baltie" (R1).

Programming has become a noticeable trend at every stage of education. Students begin to learn coding in a way which allows them to combine abstract thinking and concrete-imagery thinking. The example of such activities may be programming of robots or virtual characters. Programming thinking develops as students reach the subsequent stages of education. In Poland, coding is introduced already in the initial stage of education - integrated teaching. Robotics and coding are very popular. Numerous non-formal education offers of courses outside the schools, which involve classes to support the development of commutative, algorithmic thinking confirm this fact. Computer programming has become not only a fashion but also the means of early support of mathematic and abstract thinking.

"Apart from devices we know from the market, like, I don't know, different laptops or tablets, more and more often - due to some fashion but also this formal introduction of coding into the core curriculum - schools use all kinds of programming environments which are used on certain devices but also in the Internet. Then, there are simple solutions which allow teachers to work with the students, there are many of them. Besides these so called software opportunities or environments, all kinds of analogue environments are available to introduce students into the world of algorithmic and coding processes. Also, different robots which can be programmed are used. They enable practical application of the work students do on computers or other devices, physical implementation of their programming ideas. Of course, it all depends on the level of students' development, the stage of education they are at" (R2).

The third respondent addressed a very important issue. In Polish schools, multimedia presentations (created using MS Office applications or free equivalents) are most often used. Transferring educational content into presentations and then showing them on a projector has become a norm. Many schools have interactive boards and multimedia projectors as their standard equipment. In many cases, permanent use of this tool leads to discussions about the effectiveness and soundness of using multimedia presentations as the main didactic means.

"I think this depends greatly on, first: our definition of ICT. Then, what it means "to use". Because when we look at it very simply, then every teacher in Poland uses ICTs in some way. Most often, it will be slides and interactive boards" (R3).

According to the representative of the second sector, particular consideration should be given to applications which facilitate student collaboration. Solutions to support project and group work most often include text editors and file repositories, which enable exchange of ideas or marking valuable content. Perhaps, the respondent emphasizes the significance of this area due the need to strengthen team work and ability to build knowledge while engaging all the students. This area is one of the challenges of modern media pedagogy focused on shared learning, constructivism and soft skill development (such as communication, arguing, sourcing, experience sharing and learning from mistakes).

"Collaboration method such as goggle-boxes. Collective work as students implement different projects. There are many available tools for collective work. I could spend much time listing all popular tools to design, note sharing. For example Eric. Great tool to create notes in books. Also collaborative. I personally think working on a single document is the best. The simplest solution are goggle-boxes which may be used by many students. In this way, as they work on one document, they constant-

ly build new knowledge. And thanks to collaboration, contribution and ideas of everyone are visible" (R3).

Obstacles to introduction of modern ICT-based solutions in Poland

Openness to new solutions is crucial for implementation of ICT-based teaching solutions. According to the respondent who manages a third sector institution, the lack of resistance and ability to respond to new solutions by integrating them into didactic methods used is the key factor. This ability to introduce new solutions is strongly associated with the lifelong learning process. By definition, teachers should be particularly open to innovations, experimenting and entering into the world of learners. According to the TPACK concept, the effectiveness of ICT implementation depends mainly on a teacher who should hold certain attitude to pedagogical experiments and be open to new methods.

"I think there are two main ones. One is internal, it is this inner resistance. Because if someone is open to innovations, there is no problem. Regardless whether it is a teacher, doctor or university professor. If they are open to new things, they will introduce them, take interest in them and look for opportunities to use them in their lives. But is a person is closed, they will constantly look for excuses for not doing anything" (R1).

This respondent thinks that implementation of ICT in education is not easy due to the complex and wider view of the role of media in education. Lack of clear subject and competence boundaries blocks the implementation of devices, websites and applications to support learning and teaching. For many teachers, one of the blocking factors is that digital devices are stereotypically assigned to the IT area.

"And the other factor is more complex, because I think it is system-related. Because if we are to implement ICT in schools, the question is when, during which classes etc. So, the simplest answer is: IT class, right? However, teachers of other subjects are urged to this. But I don't know if it all works well in the end" (R1).

The respondent adds that the core curricula and the digital literacy development concept lack coherence. As already mentioned above, one of the present priorities is the development of algorithmic thinking and programming skills. Unfortunately, there is much freedom in this area in terms of selection of didactic methods, forms and means, as well as big discrepancy in interpreting the core curriculum by the teachers. These limitations result in many inconsistencies in the transfer and spiral development of programming skills.

"Imagine that kids learn coding since the early grades, right? At least in those schools where teachers are already prepared. Because they got tablets and LEGO for coding. So they have learned the first steps. And now, these kids complete their early school education and go to grades 4-6 and have IT classes. And what do they learn? For example, in grades 4-6 they should continue using Scratch, keep on building, creating, designing but this is not always the case" (R1).

The school director rightly mentions the issue of competencies of the prospective and present teachers. As the experienced manager and recruiter of pedagogical staff, he points out to their professional preparation. Training phase is not always logically connected with the tasks performed later in education institutions. Digital literacy of the prospective teachers does not always match the didactic process and requirement regarding operation of applications, hardware or websites as well as pedagogical challenges connected with digital media.

"I need to emphasize the problem of teacher competencies which formally are not trained as they should. When teachers prepare to begin their career, their competencies do not quite match the needs of schools I've just mentioned. That is why, it is very important that teachers are aware it depends on them and that they need to re-calibrate the way they see young people in the educational context" (R2).

The school director also points out to another key issue, namely organisational limitations. Many teachers want to experiment and introduce new technologies but this process gets restricted due to the limited access to proper hardware or Internet connection. The matter of proper equipment is seen as one of the factors hindering ICT implementation. However, we must add that the problem of supplying schools with technology is an ongoing process as devices get old and new solutions appear in the market.

"The first area is the most important and is connected with competencies. And I want to emphasize once again, we have many great educators and we know it. This is beautiful. And we see a duality here. Because many of these aware, active and willing teachers face technological desert in their schools. So, it is something that limits them in their efforts." (R2)

The respondent also mentions the specific digital division in Polish schools. Different formal education institutions have different digital teaching tools. Many directors and teachers face this problem. To eliminate this digital gap, central projects are introduced - ministerial initiatives

focused on equipping schools, providing high-speed Internet connection and improving digital literacy among the teachers.

"On the other hand, there are also teachers who work in well equipped schools and have access to full ICT environment. But behind it, there is something inevitable - this digital division and large-scale projects implemented by the ministry are to resolve it. So, in a while all Polish schools will actually provide equal opportunities in terms of technology. This will take long, but these are the plans. They are actually being realized" (R2).

According to the business sector representative, one of the greatest barriers in using ICT in education is digital literacy of teachers. This respondent said that it is knowledge and skills of the teachers that are usually insufficient. To improve this situation, teachers should avoid trainings which are not adapted to their subjects or, in a wider perspective, to school conditions. The solution might be the exchange of experiences among the teachers. Education based on the transfer of knowledge and skills within the school system eliminates trainings which are not compliant with the core curriculum and actual school conditions.

"However, I think teachers' competencies are the weakest link. Equipment is less and less important but teachers' competencies are, in my opinion, very poor. Teachers still use ICT insufficiently. There are also not many good trainings in this area. And I think that if there are any trainings, they are not adapted to the needs. I think teachers should exchange their experiences. They should collaborate, share their experiences and learn to use valuable tools together" (R3).

Hardware and human potential and ICT-mediated education

Changes resulting from the development of human capital do not happen in isolation from the other social processes. According to the school director, strengthening human and technology capital during the last years has been noticeable. This happens both, through the change of content taught (especially computer classes and IT) and supply of schools with the new hardware. This process is also influenced by the needs of the labor market, as well as by the development and implementation of technologies into vocational education (secondary schools). The respondent said that schools are responsible for updating and modernization of their teaching according to the needs of local community and economy. Since the transformation, this aspect is the greatest challenge of Polish educational system.

"I think not much has changed during these last 10 years in this context. I think that globally, it could still be better. But there are schools, and

this is a very narrow group, where different processes happen parallel, also in the context of other teaching areas, other subjects. Especially when financial opportunities were created for schools to get equipped with various hardware solutions. Another question is whether all these solutions will change at least a little the image of schools and, first of all, will they help to meet the needs of the changing school surrounding. In short, we could say that this is the strong trend resulting from the conditions in the labour market and services market. It all goes towards the Internet of Things and Artificial Intelligence. And schools cannot stay behind. I think school should be students' guide through this world" (R2).

According to this respondent, there is the necessity to re-orient the focus. ICT equipment is crucial but human resources are even more important. Teachers and trainers are among the ones who are the most responsible for the development of formal and non-formal education. These people are education leaders and are responsible for creating optimal learning environments. Teachers are the critical and key element in the ICT and education ecosystem.

"I look at it from a little different perspective. Because I'm sure that devices and ICT environment available in schools are just a tool, a means to achieve the goal set for the school. First of all, in the functional meaning, it is set for the teachers. In fact, focusing on the technology is not that important, we should rather emphasize the meaning of individuals and the environment." (R2)

The above mentioned statement shares some common observations with the one of the business representative. According to him, teachers are the key. However, the respondent points out to the challenges connected with teachers' promotion. Due to the metrical age of Polish teachers and their development in the previous years, the vast majority of this group hold the highest degree of professional promotion. Lack of motivation factors prevents them from introducing innovative, ICT-based solutions. The respondent postulates development and popularization of the lifelong learning idea also among the teaching staff, however he does not provide simple solutions, only a postulate.

"First, without high-speed Internet we will not make it. And second, I think it is hard work to develop the mentality of lifelong learning among the teachers. This is something that would need to be explored, for example through international analyses. In the recent years, we have seen the rapid leap forward in education, the level of teacher training. And they have probably completed hundreds of hours of trainings because everyone wanted to get their promotion a decade ago. But now, it is a little harder because everyone probably already has their diplomas. Statistically, teachers are getting older and I think it is hard to motivate them

to learn. So I think, this is a systemic solution which will facilitate lifelong learning. Unfortunately, I don't have a solution to this, it is a new challenge" (R3).

Role of business in educational sector

The NGO representative thinks that the business sector is oriented on generating revenue. Activity of the second sector representatives in education is less noticeable for the first stages of education and slightly more observable in secondary schools. According to the respondent, this is the result of the simple assumption that businesses are to generate income. Sometimes schools participate in the organized forms of support (like free access to office software for the students) but this is not the rule in all schools.

"Business, according to its very name, has to have a business interest in it. And this is surely more likely in secondary schools and in higher education, where businesses invest and benefit. Businesses will rather look for money in school and school is a good client because it is the state that pays. So I don't really believe that there is a business which would not have an interest to support schools" (R1).

The respondent from the business sector confirms these observations. Commercial sector offers little support for the schools. This is also due to the fact that for schools, voluntary contribution is the priority. The issue of corporate social responsibility is a different matter, as it usually involves activities reaching beyond formal education and implemented by foundations and associations focusing, for example, on prevention (also media prevention).

"There is a great interest in doing business in education. And if you ask whether business supports education pro bono, well, there is not much support here. For sure, it happens occasionally. But I think that education is not an important topic. At present, there is no trend to support education" (R3).

From the perspective of the school director, business sector plays a significant role in modernization of educational institutions. This is particularly relevant for institutions which offer programming and education equipment. Presentation of the offer and the opportunity to use ICT in schools facilitates implementation of new didactic means or forms of work. Without knowledge about hardware and software, gained for example during methodic conferences, teachers may have problems finding out about the latest technological solutions. Very often, representatives

of the commercial industry participate in educational events (teacher conferences, seminars) where they present their latest products.

"Without business which offers solutions, we would never had, never have spoken, we would never... or at least not today, we would be stuck where we are. We as the school, but I think education in general. Shortly speaking, it is thanks to certain initiatives which enabled businesses to show what they have to offer. This is, of course, quite radical but I believe this was the main motor of these changes" (R2).

In the light of the statements of the third respondent, we may notice that the educational sector is attractive for business only. This is due to the purchasing potential of schools. Formal education units are attractive business partners because of their number, purchasing potential and the need to be constantly modernized.

"I think education business is powerful. As I was taking part in different conferences, whether it was Oslo, Cracow or Lumen'y, I have noticed that education sector buys and will buy lots of hardware and software. Always. These purchases contribute to a great share in Polish GDP. Polish schools may not be very rich but they are plenty. It is mass purchase for both, K12 education and university education" (R3).

The same respondent adds, that the last decade has been the breakthrough for education industry and business. Both, supply and demand have been growing. The attitude of the stakeholders towards ICT implementation in both, schools and universities, also changes. The development of the ICT industry, including adaptation of the offer to the needs of schools, drives the interest of education sectors representatives in new hardware and applications.

"While ten years ago, I thought buying innovative ICTs for universities is a fancy, now I say universities (I'm not saying all of them) have matured to buy advanced, world-class tools. As for the Polish market, or K12 area, there are plenty of educational toys. We keep discovering new things available on the market" (R3).

Polish education system, both higher and formal, uses the opportunities provided by the structural funds. Many modernization projects base on the central, ministry programs which aim at the development of digital literacy and supplying schools with digital devices. In the opinion of the business representative, universities now introduce more and more advanced IT systems to support not only their didactic processes but also administration and the quality of learning. European funds are one of the many noticeably stimulators of ICT implementation in schools.

"It is a good time for academic education because there is a lot of money from different EU grants. We can see for some time that universities have been in much better condition. I can see they buy LMSes. They buy some pro-quality systems. This has never been before" (R3).

ICT and education innovations in Poland

More and more often, practical efforts combine innovations and final changes in the curricula. In many cases, innovations involve preparation of teachers to use new didactic methods, forms and means. The issues mentioned in the previous sections regarding algorithmizing, computing thinking or robotics translate into the educational projects addressed to teachers. The representative of an NGO mentions an interesting example. Referring to her words, it is worth to point out that pedagogical innovations are very often implemented through one-time trainings in the trainer-teacher setting, outside the real teaching and learning environment. In the example mentioned, trainers introduce innovations together with students and teachers. Thus, the teachers naturally participate in transferring the core curriculum into practice.

"Together with Humanitas University we implement the project Eksperci Programowania (Coding Experts). In this project, early school teachers learn how to teach algorithmic thinking. There is a Ministry program called Digital Poland. This is a very innovative project. We developed different new work methods ourselves. And during the trainings we not only educate the early school and pre-school teachers using different types of tools, games, plays, robots. Including Scratch and Balti. The workshops should be led in a way so the female teachers, because they are mainly ladies, did not get discouraged that they cannot build and program robots but that they would finally decide it is actually fun. And the project is good because it involves not only stationary trainings - our trainers come to classes and co-lead the lessons with the teachers" (R1).

Learning and teaching may be interdisciplinary when interdisciplinary education paths are taken into account. Digital literacy is not a separate field so ICT-related content may be integrated in other, separate disciplines (different subjects/courses) too. Combining content and focus on practical application is not the dominating approach in Polish education. Such activities are classified as innovative. In addition, creating projects aimed at social change is highly rated by methodology experts and positively received in the context of the principles of social pedagogy. An example of this type of activities connected with global challenges was mentioned briefly by the school director.

"The example is a flagship project which we carried out with two other schools in our city and five other schools in Poland. The project is called Code for Green. It is interesting because in this project students, starting from the seventh, eighth grade and consequently, in the secondary school develop their competencies in coding, algorithms, prototyping, experimenting. They use the new skills to change their local natural environment in the first place. The project is deeply grounded in ecology and promotes changing and improving the environment students live in. After 18 months of the project, we can see how engaging it is for the students and how great effect it brings" (R2).

Polish education services market is very innovative. This is confirmed by some very popular solutions used not only in Poland but also abroad. The level of innovation in the project is proven by the fact that some webpages are used not only locally, but broadly. Innovative approach manifests itself through different applications of ICTs. Polish solutions for ICT-based learning and teaching have global application in the areas of: e-learning, print, robotics, mobile applications, leisure activity or learning support. Many businesses have their English speaking departments and branches outside Poland. The third respondent summarized it as follows:

"Nuadu - pretty cool e-learning platform. They also have financing team. Then, Learnetic which also have many successes in international markets. Then, PCG Academia which is, for example, very active in Oceania. And very successful. Also in Germany. Wide-scale use of printers in education by Skyware Company. Another example is Bikeo by Andrzej Grzybowski. Robotics, that is Foton Company. Black Bot has also successes internationally. In my opinion, Brainly that is Zadane.pl in Polish, is worth keeping eye on. Do you know what it's about? It is a platform to do homework, you know? Because it is a company that has, I guess, out of top ten educational websites, they have four. So it's like American Brainly, British Brainly, German Brainly. For sure, they are one of the top ten most often visited educational websites in the world and have around a billion unique users" (R3).

Supporting development of ICT-related skills among people responsible for learning and digital inclusion

The first respondent points out to a very important assumption. Many trainings to improve digital literacy among trainers and teachers are one-time events. It means that pedagogues take part in an intense training in their school or vocational training centre and then go to work where they are not always successfully implement what they have learned. This situation could be resolved thanks to methods suggested by the NGO representative.

"Teachers often go to a training, get trained and have to put it into practice in their classes. Usually, it all ends with the training. It is difficult without support. On the one hand, support is disciplining and motivating, on the other hand, it gives the sense of security that if someone fails at something, there is another person who will help" (R1).

Too many training offers in the Polish teacher lifelong education market result in different quality trainings. Teachers very often pay attention to the relevance of content and usefulness of trainings to improve the quality of their teaching. Unfortunately, Polish vocational training market is not regulated in this regard, so there are examples of low quality courses. Verification and certification of teacher training centers becomes a challenge.

"Going to a training, teachers always look not only at the quality of the training, the content, what kind of knowledge and skills do trainers present but also how do they learn the training, what methods are used. It is important for them. So I think trainers cannot be random persons" (R1).

The school director's perspective is clearly focused on the idea of support. Implementation of ICT into learning and teaching and strengthening digital literacy is hindered if the school lacks clear vision of development. Without the contribution of the school management whose role is to create conditions stimulating implementation of the new solutions, it is impossible to ensure optimal solutions. The respondent mentions another factor, namely teachers' self-reflection regarding their professional development.

"This comes from the full awareness of teachers, based on their willingness to improve. Second, I can see two roles here. Of the teachers but also of the school or school environment in general to support such efforts and create conditions. This is the role of the school management, director, to create conditions for daily, or as frequent as possible, access to solutions which teachers can implement, yes. Because one may have many great ideas and try to introduce them, but we need the right conditions to do it" (R2).

The school director suggest the same solution to the problem of low quality of the trainings, as the one posed by the first respondent. Knowledge accumulated by the teaching staff could be the means. It is teachers who have wide experience which may be the starting point for educational courses for them. In this case, shared learning has its equivalents in the Polish non-formal education system. There are informal communities like SuperbelfrzyPL or closed self-learning groups in social media. Many of these activities focused on strengthening digital literacy and improv-

ing the didactic process are performed by using ICTs, especially VOD transmissions, discussion forums, discussions in SNS, online tutorials and guides.

"Shared learning of teachers in the school environment where they work. Sharing experiences and insights. And I think training teachers somewhere out there is not exactly a good idea. We can say that more and more often it is from home or school, because webinars have become so common like real meetings, perhaps even more. This is also a method to learn about good practices. And the strength of these meetings should be the fact that these are people who have something to offer in the context of the ideas and certain recipes how to do it. Because we need to remember about certain resistance against new things, innovations which we may not fully understand. That is why I think that this engagement that comes simply from the passion for teaching should be supported with self-development and, first of all, collaboration between the teachers. And I think this is the key - the daily improvement, I mean teachers improvement" (R2).

The perspectives of the school director and the representative of an education unit are coherent. Both respondents emphasize the importance of exchanging the experiences among the professionals. Imposing curricula does not always meet its own assumptions. One can list several more or less effective central project implemented in the last few years. Many of them were based on creating teaching content integrators as e-learning platforms or e-book series.

"The Ministry of Education should rather encourage people to share good examples. The Ministry did exactly the opposite last year, they said: Oh, let's buy them a new textbook platform. I really think teachers don't need a new textbook platform. The times are different. They can find a lot on their own" (R3).

The same respondent refers to the statement of the previous interviewee, highlighting that exchange of experience, especially good practices, is the key to supporting ICT literacy. This is one of the proven solutions, not only in the area of acquiring and improving digital literacy but also other, "analogue" areas.

"I strongly believe that if education is to improve, we must stop creating these huge LMSes. All these resource buying projects. And simply start teaching these people good examples. Show them best practice. They really don't need anything else" (R3).

The last respondent points out to the important fact of permanent change. During the recent years, Polish formal education system has undergone many fundamental changes. These transformations included liquidation of the lower-secondary schools addressed to adolescents in favor of longer primary education. With these changes, teaching content got restructured, which resulted in new student and teacher textbooks being created. Every change means the necessity to update the existing knowledge by the subject teachers and school management.

"In education everything is constantly turned upside down. There is a new core curriculum and one has to create new lesson plans. This is something which frustrates me. I think it is very ineffective way of working. What does that teach you? Instead of searching and thinking, take a ready-made template. But this is not about forcing people to use one and only right project which will change in a minute anyway." (R3)

Open education resources and work with disfavored groups

Usage of Open Education Resources (OER) within the Polish education system is the area which has not been fully explored. There are many examples of successful use of teaching content available and indexed in popular search engines. Teachers themselves also create their own repositories of links which they then share with others. Polish online resources include many websites with class scenarios, books, exercises and video materials. One of the most popular resources is a library of several dozen of textbooks available for free and created within the Human Capital Operational Program 2007-2013 and Knowledge Education Development Operational Program 2014-2020. There are also many discussion forums or microsites with the lists of useful OER. The second respondent confirms that teachers contribute to the creation of this type of online resources:

"Commercial part of the resources and services available - this is a very important element. Knowing where to look for open resources is a common practice. The choice of certain environment, tool or information source is usually individual preference. I can only say that about two years ago, we had an open lesson project for the teachers in our school, during which teachers developed education materials in pairs. They addressed certain educational cases at different levels, for different subject courses. The result of this quite tedious and long, but based mainly on open resources work was twelve publications which appeared in a commercial repository but in an open channel. And at some stage, they were competing with similar publications from the US, we have evidence for it" (R2).

Open character of education resources is dual. According to the business representative, all education resources must be published in an open access mode because they are created for public money. On the other hand, it seems natural that free access to materials developed by commercial entities is blocked. According to the third respondent, open access to resources is a remedy for domination of business institutions and a necessary solution. And then, there is classification and segregation of OER and their effective use by teachers and trainers.

"I will tell you that my opinion about open education resources is very clear. If something is made for public money there shouldn't even be a question whether it should be an open resource. It's not a surprise that businesses do not want to create open resources. It is hard to expect that, for example Black Bot will release its LMS on an open license when they earn milliards of dollars on it. So, I think that in 2019, there shouldn't even be a discussion whether resources should be open or not. And this is a way to challenge the domination of big corporations at least a little" (R3).

Creators of OER often forget about positioning the resources for people with disabilities. This element is very often missing. Another problem is OER description in the context of copyrights related to the use of materials as educational activities may have different character. Using OER in formal education may be interpreted in one way and differently by the representatives of the commercial sector (like private training institutions). The following statement is a valuable postulate regarding OER classification and creation of repositories and files given physical limitations of all the Internet users.

"The question about value is rather the question about availability. I mean, if we think about public resources in particular. For me, resources which are publicly available and are created for public money should be fully accessible. Both in legal and technical sense" (R3).

Supporting ICT use in learning and social integration in Poland in the light of government actions

One of the primary issues related to ICT use in learning and teaching is financing. Securing the budget is the first element in thinking about digital inclusion. Like other European countries, Poland uses funds form the European Union budget. They are granted within programs aiming at developing human capital, strengthening coherence, reducing social divisions or modernization of education systems. As rightly pointed by the representative of the third sector, there are some bottom-up and free activities but they are not enough to meet all education needs.

"There is a lot of it, mainly funding initiatives from the EU funds. They all include financial support. Every project needs to be funded. There are some free activities but that is not it. And imagine that, for example, you want to do something voluntary, well, you will not do it full-time but in your free time. But if you want to have professionals, you have to have budgets and money, and then account for it. So there are mainly regional, EFS projects where schools are supported and financed by project managing institutions" (R1).

According to the same person, there are big differences in education projects and government efforts, depending on the location. The NGO representative says that in small towns and villages the financial needs are diagnosed much more effectively than in large urban areas. It is worth mentioning that education in Poland can be financed from different sources. The main one is the supervisory entity (most often, local government) but schools also receive support within central projects implemented by the Ministry of National Education and education authorities. Support is also very often provided by the local government organizations which implement projects addressed to education sector.

"It works best in small towns because in a small place there is one, two schools. And they usually all know one another in the local community. And when the school director talks to the mayor and says they need something and a project needs to be implemented, they agree on something together and do it together. In big cities it does not look that good because usually, there is a unit within the leading entity, which is in some city halls, manages the project. And this unit sends information to school directors and the directors ask their teachers what do they need and then they quickly write a project" (R1).

Important questions and conclusions regarding the support were posed by the school director. First, he notices the changes resulting from different channels of support. He also adds that one needs to be aware that having a project, that needs intellectual (methodic) and technical support, is not the final stage. Adaptation of the support to the goals of the institution and conditions related with the teaching staff in a given institution seems much more important.

"If you ask how these programs contributed to the change, of course the impact is noticeable. Nevertheless, I would not consider it globally. I would look at the changes locally. Because every school should have, it would be good if they had, their own concept how to use this new equipment according to their specifics. Yes, competencies and needs of the teachers. That's why I am far from generalizing because every school should have their own recipe for successful realization of education objectives" (R2).

The same respondent then lists different types of centrally financed programs. According to him, two initiatives involving hardware supply deserve a closer look. One was providing schools with access to high-speed Internet and educational resources. The other involved buying interactive digital boards and implementation of educational software. The respondent emphasized that how much these projects stimulated the increased use of ICT depends on the previous activities introduced in a given school. Some schools have been focusing on improving their teaching methods for years and such projects were only complementary.

"For years we were beneficiaries of a pilot project called Digital School. I will not hide that opportunity to take part... random opportunity because we were randomly chosen as the project beneficiaries and were able to equip the school. This was a right moment. Because we had something we were simply missing while implementing previous activities related to education, teacher support and competence development. We were able to equip the teachers then. Another big project, every director knows is Active Board. I think this is the project which has helped many schools or has given them green light to act. But for the schools which had already been advanced in ICT implementation or has some experience with it, it was complementary" (R2).

Functioning of every school in the information society is based on the access to high-speed Internet. Due to administrational, financial and technical limitations, until 2019 not all Polish schools had such access. The solution is a central, governmental project to provide all schools with this crucial support. Some schools, most often those located outside large cities, stay behind. The third respondent points out that in many schools such projects do not matter much because broadband, stable connections which enable creation of high-speed school intranets and Wi-Fi for the students have already been provided few years ago. Such projects are the base on which other ICT-based solutions can be created.

"And we have the national education network project of which I am a fan. Because it is something beautiful to realize, such a big initiative. Very needed, I think, and much too late introduced to Polish education system. Nevertheless, very much needed project of connecting all schools in Poland to standard, secure Internet. I might just add that in our city, we reached the target level four years ago. We already have our own context related to these services so for us not much will change. But there are plenty of schools for which this means opening to the world and a real change (I don't want to say evolution) in the context of the quality of using digital services. But we are talking about something which, as I have already mentioned, should be the standard and still isn't in many places and in many schools" (R2).

The last respondent also refers to the National Education Network project (OSE, Ogólnopolska Sieć Edukacyjna). This project involves not only access to high-speed, stable Internet but also securing the school networks. Strengthening security includes filtering the content sent via the school networks. It is an important task which goes beyond the standard services of Internet Service Providers (ISP).

"You know what, the answer depends on which agency and when. Surely, there are better and worse moments. OSE is definitely a good project. As I mentioned, among these I'm familiar with. I don't know if it is well implemented. But for sure, it is a good program" (R3).

Discussion

Use of ICT in formal and non-formal education in Poland is an interesting problem which is addressed at different levels of narratives among the teaching staff and scientific analyses of media pedagogy experts (Plebańska & Halska, 2017; Plebańska, 2018). In each of these narratives teachers play the important role as the key persons responsible for ICT implementation into learning and teaching. Preparation of teachers to the process of equipping schools in IT solutions brings about many challenges (Tomczyk et al., 2019). ICT-based education technology raises many discussions, especially regarding the challenges of expanding the curricula with new areas like coding, domination of some didactic means like multimedia presentations, or rarely used methods of team work (Stosic, 2015; Novković Cvetković, 2018). The areas of challenges are presented in Table 1.

Table 1. Use of ICT in formal and non-formal education in Poland

Teacher as the key person
IT teachers do not always teach ICT as their primary subject.
Sociodemographic characteristics of teachers determine the way ICT is used.
Low quality hardware and Internet connections in some schools
BYOD - as insufficiently developed approach
Algorithmic and coding thinking as priority activities
Multimedia presentations are used most often.
Multimedia presentations more and more often cause resistance and lead to discussion.
Using tools to support team work as a challenge

According to the respondents, one the most common obstacles to ICT implementation is the lack of openness to innovations among the teachers. This is a serious accusation, oftentimes without real grounds. Early education teachers in particular (Gałecka et al., 2017) experiment, introduce new didactic methods, forms and tools into the integrated teaching curricula. Ability to implement innovations is one of the universal competencies of pedagogues, which should be trained by the prospective teachers (Plaskura, 2019). The human factor is also connected with low digital literacy among the teachers (Tomczyk, 2020). This factor is often associated with insufficient methodic support and assigning IT courses (computer classes) to teachers for whom this subject is only additional (Kosiba, 2012; Pyżalski, 2010). The most common obstacles are presented in Table 2.

Table 2. Obstacles to introduction of modern ICT-based solutions in Poland

Openness to innovations, lifelong learning
Experimenting, ability to introduce new didactic means and forms of work
Stereotypical classifying IT-related activities as separate subject
Different interpretations of the core curriculum
Lack of proper preparation among the prospective teachers
Ageing equipment, upgrade of hardware in schools
Low level of digital literacy among teachers
Lack of adequate support for teachers

Teachers are considered one of the professional groups constantly improving their competencies. Their profession requires ongoing updates of knowledge, competencies, skills and in some situations, change of habits (Szpemruch, 2013). Teacher competencies development is a universal and global challenge. Teachers are one of the key links in the didactic process. The respondents pointed out that school transformation is impossible without the participation of the pedagogues. Thus, human capital becomes critical for the introduced changes (Konieczna-Kucharska, 2012; Kędzierska & Potyrała, 2015). The detailed list of human capital development indicators is presented in Table 3.

Table 3. Hardware and human potential and ICT-mediated education

Constant development of human and hardware potential
Transformations and modernisation of Polish schools
Human resources more important than technology resources
Teachers as critical, key element
Lack of motivating factors

The participation of business in educational activities is still insufficiently explored. On the one hand, we know that commercial institutions aim at generating revenue, on the other hand, it is schools that use these commercial solutions and prepare future employees. The respondents point out that this division is logical and clear. Nevertheless, contribution of the commercial sector is particularly important in the aspect of school modernization, for example through implementation of technological innovations or modernization of vocational training curricula or student internships. For more information see table number 4. (Gondek, & Makarewicz, 2016).

Table 4. Role of business in educational sector

By definition, business sector is oriented towards generating revenue.
Low level of support offered to schools.
Business sector plays significant role in school modernisation.
Schools are attractive customer for the business sector.
Supply of and demand for commercial ICT and educational solutions is growing.
Internal funds are used to purchase new hardware and applications.

Innovative education is one of the major arguments when it comes to implementation of different new solutions. Usually, innovation means changes in the curricula and the system, introduced as the response to civilizational challenges. Innovations can be introduced externally and by creative and experimenting teachers (see Table 5). Innovations and ICT are the areas which change dynamically due to the transformations of the information society (Ziemba, 2019; Wątróbski et al., 2019).

Table 5. ICT and education innovations in Poland

Changes in the core curriculum force innovations.
Innovations are often introduced to schools by external entities.
Activities in favour of social change (practice) are highly valued.
Integrating ICT into interdisciplinary education.
Polish businesses become global players in terms of innovations and education.

Supporting the development of ICT-related skills among people responsible for learning and digital inclusion process is one of the components of lifelong learning (Szarota, 2019; Starčič et al., 2007). Based on the material collected, we have noticed that there is the need for critical evaluation of professional improvement of teachers in Poland as the quality of some training forms and the training content are sometimes inadequate to the needs. Also, the intense development of support communities among the teachers has been observed. Informal groups focused on improving methodical competencies and digital literacy are not a new phenomenon. This trend, however, should be further explored as part of the future research into the cyberspace phenomena. Table 6 summarises the challenges faced by the teachers in the area of self-development.

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

Lack of regular support, mainly single meetings
Different quality of courses to improve digital literacy of teachers
Teachers' self-reflection about developing own competencies
School mission should be coherent with the idea of development support.
Knowledge sharing and learning teacher communities as new trend
Changes in education system force teachers to acquire new knowledge and skills

Open education resources are one of the main source of interesting scenarios or teaching tools for the teachers. Many outcomes of the projects financed from the public sources are disseminated as OER. Unfortunately, despite the availability of many files, videos, exercises and scenarios, the respondents notice lack of standards for positioning and creating the repositories. Resources are very often inaccessible for people with disabilities (Plichta, 2017; Młynarczyk-Karabin, 2019). We can also observe that teachers engage in creating and sharing their own didactic materials. Such efforts should be supported and presented as good example. The challenges are summarized in table 7.

Table 7. Open education resources and work with disfavored groups

It is popular but insufficiently explored solution.
Teachers contribute to OER development.
Central programmes are based on OER technology.
Resources created using public money should be available as OER.
OER is the answer to domination of business institutions.
OER should be available to all Internet users.
Files need to be classified.

Supporting ICT use in learning and social integration in Poland in the light of government actions is the phenomenon which has developed in the EU during recent years. This is thanks to many financing sources. Human capital development and reduction of digital divide (Hofman & Tomczyk, 2012; Tomczyk, 2018) are some of the top priorities related to removing social divisions created as a result of intense development of the information society. Most of these initiatives are based on regular programmes financed from the European Union funds. According to the respondents, some deserve special distinction. At the same time, there is still room for improvement in this area, for example regarding incomplete diagnoses which should include local conditions (including goals and needs of institutions). As for good practices, we must mention activities of Polish institutions towards digital inclusion such as: Universities of the Third Age, Senior Clubs, informal societies which complement the central programmes and are the answer to the needs of small local communities - summary presented in table 8 (Mackowicz & Wnek-Gozdek, 2016; Mackowicz & Wnek-Gozdek, 2019).

Table 8. Supporting ICT use in learning and social integration in Poland in the light of government actions

Providing financial support from EU budgets
Non-cyclic bottom-up initiatives
Diagnosis as the key element of systemic ICT implementation and digital inclusion
Setting goals of institutions vs local needs
ICT implementation is very diverse process.
OSE (National Education Network) as one of the leading projects.

The presented results do not enable generalization of opinions for several reasons. First, due to the character of the study which was qualitative. Second, due to the limited sample consisting of only three persons. Third, the problem of ICT, education and inclusion is differently interpreted depending in the respondents' profession and their perspective resulting from the represented sector. However, the results presented herein, give some general view of the situation, which may prove helpful during designing quantitative research (to measure the scale of phenomena) and comparative studies. We also postulate to conduct similar and more in-depth interviews in a saturated sample. The results presented may be also valuable for the stakeholders who try to understand the ICT-related changes which turn out to be global in the context of such key education factors as: teacher, modernization of education system, improvement of curricula.

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Exploring needs of ICT for Enhancing Inclusive Education in Turkey: Challenges of ICT Integration in education through the views of experts from business, government and university sectors

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Abstract

The purpose of the study is to determine the needs of using ICT in Turkey as part of international cooperation called "Smart Ecosystem for Learning and Inclusion (SELI)" which seeks to support inclusive education. Accordingly, the case study model, which is one of the qualitative research methods, was used in the analysis of the SELI Learning Platform within the framework of 'Information and Communication Technologies', 'Digital Storytelling' and 'Inclusive Education'. Case study, is one of the research methods used in the field of educational technologies. The most important feature of this research model is the situation in the research that is chosen by the characteristics of the individual or the community, handled within each counterpart context. Due to this feature; a case study is described as a qualitative research method such as ethnographic research, phenomenology and embedded theory research (Johnson & Christensen, 2004). Since the same research questions were answered in different situations, multiple case studies were used to determine the needs of the SELI Learning Platform. Multi-case study is a research model that provides strengthening and diversifying results by addressing a few similar situations. Within the scope of the research, the data obtained from the research questions created for three cases are an important source in determining the needs.

Introduction

The goals of societies in today's global competition; is that individuals have 21st century skills and use developing technologies effectively. The most important step towards this goal is that individuals receive an education to use information and communication technologies (ICT) correctly and effectively. Technology integration has become a necessity in education, which arises out of the need for education and technology to be intertwined, as well as traditional methods and techniques. As a result of this, investments for the use of technology in education are increasing day by day, educational institutions are equipped with these technologies and opportunities are provided for each student to have the opportunity to meet new technological equipment. Therefore, it is possible to say that learning environments using informatics technologies are rapidly expanding and studies towards this situation have gained speed in parallel. Various steps have been taken on how to use constantly developing technology more effectively in the teaching-learning process since 2004 in Turkey. In this context Mishra and Koehler's (2009) Technological Pedagogical Content Knowledge (TPACK) model which defines the relationship between Technology, Pedagogy, Content is used as a base for the integration of ICT in the educational process (Mumcu, Haşlaman & Koçak-Usluel, 2008). MoNE (Ministry of National Education), YÖK (Council of Higher Education), many private companies, experts, academics and teachers are constantly working and renewing themselves to overcome the obstacles that arise during the implementation of this model. As this research supports inclusive education with ICT, we discuss the results on views of three stakeholders in accordance with the relevant literature as part of need analysis of the SELI Learning Platform.

Research Group

The study group of the research was determined by criterion sampling as one of the purposeful sampling methods. According to criterion sampling, observation units in a research can be formed from individuals, events, objects or situations with certain qualifications (Büyüköztürk, Kılıç- Çakmak, Akgün, Karadeniz, & Demirel, 2014).

For the purpose of the research, the participants who were determined as a research group within the scope of three related cases. They consist of a faculty member working in the field of educational technologies more specifically on digital storytelling (P1), a CEO of private sector institution in the field of educational technologies (P2), and a public institution official working as an expert (P3) in the Ministry of National Education (MoNE). Information about the participants (occupation, field

of study and professional experience) of the study's working group are as follows:

P1: She is a graduate of Computer and Instructional Technologies. Currently, she is a lecturer at the Department of Computer Education and Instructional Technologies at Hacettepe University. Her field of study is the integration of technology in education, that is, the implementation of digital storytelling workshops, Web 2.0 tools in education and training. Her professional experience is 8 years.

P2: He is an electric and electronic graduate. He works in the field of information and communication technologies. He currently works as a CEO and CTO (Chief Technology Officer) at a company that develops online educational content for approximately 2750 private schools nationally and internationally. His professional experience is 12 years.

P3: He is a graduate of information technology teacher. He works as an expert at MoNE. He took part in the project called Movement of Enhancing Opportunities and Improving Technology (FATİH). He currently serves for teachers and prospective teachers within the Ministry of National Education as responsible of educations for the use of Microsoft Office, the use of the Education Information Network (EBA), the use of MEBSIS, the use of digital systems, the opening of robotics and coding courses. His professional experience is 12 years.

Data Collection Tool

The data collection tool of the research was created based on a conducted literature review by the researchers participating in the project from Latin America and Europe in order to determine the needs of the SELI Learning Platform. The necessary corrections were made by taking the opinions of the project partners. In this context, the data collection tool of the research includes open-ended questions about general information of the research group (such as profession, field of work and professional experience), implementation of the Information and Communication Technologies (ICT) in schools and other educational institutions, and feedback and analysis - support. These questions are given below:

General İnformation

1. Can you tell me a little bit about yourself?

- What do you teach/study/ administrative position?

- How long have you been in this position (e.g., teacher, administration and educator)?

- Can you tell me about your professional experience (background)?

- What has your experience been like in working with ICTs in education?

Implementation of ICT in schools and other educational institutions

1) What ICT-based solutions do trainers and teachers apply the most in their educational activities in our country? What worked the best and why?

2) What is the biggest barrier to the implementation of the modern ICT based solutions in our country?

3) How can we use the hardware and human potential of our country to further increase the effectiveness of ICT-supported learning?

4) How does the business sector support learning and inclusion with the use of ICT?

5) How are innovations used in schools?

Feedback and analytics – for groups requiring support

1) How should we support the development of ICT-related skills among the people who are responsible for learning and inclusion process (trainers and teachers)?

2) What methods and strategy should we adopt to develop open educational resources in our country?

3) How should we use open educational resources to collaborate with the disfavored group, e.g. immigrants, the unemployed, the disabled, seniors?

4) How do governmental agencies support the use of ICT in learning and inclusion?

Data Collection

The data were collected by an interview technique. The interview technique is one of the most widely used interview types in the field of education. One-to-one interviews are ideal interviews that allow participants to express their thoughts comfortably and clearly (Creswell, 2014).

The research was gathered between 05.02.2020-18.03.2020 in a place suitable for volunteer participants within the borders of Ankara Province, face to face and with the consent of the participants, by taking a voice record and notes. In addition, prior to the interview, consent was obtained by the researcher conducting the interview as a voice recording. Interviews took approximately 30 minutes on average.

Data Analysis

Content analysis was used to analyze the data obtained in the research. The purpose of this analysis is to reach the concepts and relationships within the scope of the research. Accordingly, it brings together similar data within the framework of certain concepts and themes and provides them to be interpreted by organizing them in a way that the reader can understand (Yıldırım and Şimşek, 2018). Content analysis was done using the analysis steps used by Thomas and Hardene (2008). These stages are described below:

Coding of Findings: At this stage, direct quotations from primary research or findings in the form of basic concepts are coded by reading line by line. After all the findings are coded, the second stage can be started.

Developing Descriptive Themes: The codes obtained at this stage are compared according to their similarities and differences and grouped to form a hierarchical tree structure. Each created group is called a theme. Each theme is created to cover the definitions and meanings of grouped codes.

Production of Analytical Themes: While this phase is close to the findings of primary studies in the development of themes, new interpretive structures and explanations are produced by going beyond primary studies in the process of producing analytical themes. Going beyond primary studies requires the use of descriptive themes derived from inductive analysis to answer research questions suspended for a while. For this purpose, more abstract analytical themes are created by comparing descriptive themes and discussing them with other researchers.

Reliability and Validity: The most important factor in accepting a research as a scientific study is its reliability and validity. In qualitative research techniques; A detailed examination of the collected data is among the important criteria of validity in explaining how the researcher achieved the results. (Yıldırım & Şimşek, 2018).

Themes were determined based on the relevant literature, codes were extracted, and a content analysis suitable for qualitative research was

made and findings were presented. The data obtained were analyzed by defining themes and sub-themes for the purposes of the study.

In this study, the data obtained and the opinions of two experts were consulted to ensure the reliability of the research. The reliability formula of Miles and Huberman (1994) was used. The formula is given below:

Reliability = Consensus / (Consensus + Disagreement) x 100

= 59 / (59 + 8) x100 = 59/67 x100 = 88

As a result of the reliability formula of Miles and Huberman (1994), it was 88%. According to Miles and Huberman (1994), they stated that the reliability of the research results that are 70% and above is high.

Results

In this part of the research, the findings obtained from the data collection tool directed to the participants forming the research group are shared.

Participants, views on trainers and teachers' use of ICT-based solutions are most frequently used in educational activities in Turkey are given in Table 1.

Table 1. Participants' Perspectives on mostly used ICT-Based Educational Solutions by teachers and trainers in Turkey

		Frequency (f)
Mostly used ICT-Based Solutions by trainers and Teachers for educational Activities in Turkey	Encouraging the use of smart boards, EBA and internet infrastructure of not only young teachers but all teachers	1
	Some applications for coding	1
	Applications / systems to alleviate the workload of teachers and trainers	1
	Trainers and teachers completing their deficiencies by getting basic information literacy training	1
	Training of computer and instructional technology teachers to learn new technology applications	1
Total		5

Participants' opinions which support Results in Table 1. on mostly used ICT-based solutions by trainers and Teachers for educational Activities in Turkey are listed below:

"In fact, the state is trying to offer teachers a lot of technology... like smart boards... internet infrastructure. Tablets were also distributed once ... But I think teachers do not use smart boards much. I think that this is also results of the researches those who use them are a bit younger generation teachers or those who are interested in technology or information technology teachers. For teachers, we have something... EBA (Education Information Network). I don't think they are actively using it." (Encouraging the use of smart boards, EBA and internet infrastructure of not only young teachers but all teachers) (P1).

"For example, we now have various applications and software for programming such as Scratch. The teachers started using them very actively. There are similar web tools. They use them too. For example, now I have conducted school experience course last semester. I can give an example from observations of pre-service teachers, a teacher developed a web page. He had been shared his practices, presentations, and activities to be held week by week. The teachers followed her site. They were following the site of this information technology teacher. They also use these kinds of things." (Some applications for coding) (P1).

"The more educational technologies reduce the workload of teachers, the more successful they are. The more it brings the extra workload to him, the more it fails. Even if a system is very good and its super outputs are applied, even if we increase the success in education to 500% as a student and as a school system, it is not possible to apply if it brings an extra burden to the teacher. There are many unsuccessful and many successful examples, but I tried to underline the thing, why are the successful ones successful because they take the workload out of the teacher. The things that speed up the work that needs to be done in the form of repetition are successful, not with the intelligence that the teacher should do as a chore" (Applications / systems to alleviate the workload of teachers and trainers) (P2).

"Our teachers actually want to come to the course from every angle right now. They haven't made a full decision right now, about what to do. Because there are new trends and technologies. They want to use them. On the one hand, there are deficiencies in basic information literacy or, in fact, information literacy. Of course, this one is not for computer and instructional technology teachers, but other branch teachers... For example, we are opening office courses. For example, we took part in the training of prospective teachers, we provided them information for use of EBA, use of MEBSİS (Information Communication Systems of Ministry of National Education), use of digital systems. For example, we also consider different trainings. Drone production as part of lifelong training courses. In public Education, 3D production is more oriented towards hobby but it it is the systems that can be used at schools. Here it is without the need for outside." (Trainers and teachers completing their deficiencies by getting basic information literacy training; Training of computer and instructional technology teachers to learn new technology applications) (P3).

Participants' opinion about the biggest obstacles in the implementation of modern ICT-based solutions in Turkey are given in Table 2.

Table 2. Participants' opinion about the biggest obstacles in the implementation of modern ICT-based solutions

		Frequency (f)
Biggest obstacles in the implementation of modern ICT-based solutions	Lack of infrastructure and financial support in public schools	1
	Teachers feeling anxiety to complete education programs in public schools	1
	Hardware access barrier in public schools	1
	Regional hardware limitation in public schools	1
	Lesser obstacles in the implementation of ICT practices of private schools than public schools	1
	ICT applications that will cause teachers to spend extra time in private schools	1
	School principals do not want to send teachers' to courses opened within the Ministry of National Education(MoNE).	1
	School principals prevent teachers participation in courses because of the statement in the "Teacher Training Regulation" of MoNE, that mentions, teachers can participate in the courses opened within the MEB, in case teachers do not disrupt their lessons.	1
Total		8

Participants' opinions which support results in Table 2 about the biggest obstacles in the implementation of modern ICT-based solutions are listed below:

"When we compare private school and public private school, private schools have more opportunities… I worked in the doctorate process in different conditions. They said that we have everything in private and they can get everything we want in management. For example, get robotic coding… They could get robots management. But in a public school, they do not have any infrastructure or financial support. When they were in the coding program, they said they are doing computer-free coding training. They are doing more activities that can be done with wooden

and pencil. They used that kind of technology" (Lack of infrastructure and financial support in public schools) (P1).

"... There are concerns about completing the curriculum. They are dependent to a program. But those in private schools can teach more because they can get out of it" (Teachers feeling anxiety to complete education programs in public schools) (P1).

"So, actually, teachers want to use the internet in schools. But there are also limitations to their infrastructure. This can be. Whether it's the Internet or access barriers from their computers. Except for some sites, you know, others are banned from entering. So you know, they can't do it every time they want to, on the one hand, so I think the biggest obstacle is that it's restricted by other people. ..." (Hardware access barrier in public schools) (P1).

"In other words, teachers want to use different applications in schools over the internet. But they also have infrastructure limitations. There are barriers to access, whether on the Internet or on their computers. Except for some sites, others are banned from entering. Then they cannot do whatever they want, on the other hand... I think it is the biggest obstacle to be limited by others..." (Hardware access barrier in public schools) (P1).

"We are in the private school market. So these are the ones we can reach. In our industry, everyone has access to technology and everyone is expected to use it to a certain level. I can say something over it" (Lesser obstacles in the implementation of ICT practices of private schools compared to public schools) (P2).

"In private schools, if the teacher will take the material prepared for him and reflect it on the screen it is done easily. She/he uses them effectively. Because it doesn't require to spend extra time. But if teachers asked to do things that require to spend additional time the teacher does not work because he has to do something extra even they are good such as asking for the printout at the end of each lesson, the surveys each student, the questionnaire in the system, sharing the survey results" (ICT applications that will cause teachers to spend extra time in private schools) (P2).

"So the obstacles are a bit complicated (laughs)... So our managers may not warmly welcome. The biggest obstacle when opening the courses is the administrators... they do not want to send the teachers to the course." (School principals do not want to send teachers to courses opened within the Ministry of National Education (MoNE).) (P3).

"There is a situation like this. There is an article for training teachers. According to it, the teacher can take the course provided in case it does not disrupt his lessons. But this is not the case. The teacher may have to disrupt his lessons in any way. Because it happens in the morning, during the course or at noon. Here, part of the lesson coincides with the course or more. The manager may not want it" (School principals prevent teachers' participation in courses because of the statement in the "Teacher Training Regulation" of MoNE, which mentions, teachers can participate in the courses opened within the MEB, in case teachers do not disrupt their lessons.) (P3).

Participants views on the use of hardware and human potential in Turkey to further improve the effectiveness of ICT-supported learning is given in Table 3.

Table 3. Participants views on the use of hardware and human potential in Turkey to further improve the effectiveness of ICT-supported learning

		Frequency (f)
Use of hardware and human potential in Turkey to further improve the effectiveness of ICT-supported learning	Providing in-service training for the target group	1
	Emphasis on the use of technology as a tool within the scope of the trainings provided	1
	Need to change in the examination system	1
	Integrating examination system in which individual skills are measured with technology	1
	Paying attention to the education of the educator instead of hardware in ICT supported learning	1
	Providing trainings on the development of technology skills of the teacher in ICT supported learning	1
	Enabling educators to guide students in ICT-supported learning	1
	Enabling educators to use training materials suitable for individual differences, to get opinions from their colleagues and to make peer evaluations with the EBA software developed by MoNE.	1
Total		8

Participants' opinions which supports Results in Table 3 about the use of hardware and human potential in Turkey to further improve the effectiveness of ICT-supported learning are given below:

"First of all, I think that the people who will use it should be given training. We say technology integration is not a thing just like introducing a tool, technology that has come out and say let's try to take it and use it. It is important to consider how can we better integrate our lessons? In other words, what kind of process needs to be in order for effective learning to take place? Design? They also need to be trained so that they can be used in lessons... For example, in-service trainings can be given to teachers on these topics" (Providing in-service training for the target group) (P1).

"I mean, our goal is not to use technology, but I think we should focus on how we can use technology as a tool" (Emphasis on the use of technology as a tool within the scope of the trainings provided.) (P1).

"Everything is examination-based in Turkey. Because the exams are a decisive factor in the lives of students, that is, if they take it well in those exams, if they succeed in these exams, their economic level has a chance to be much better in their future lives. Therefore, the country's reality is based on these exams in the whole educational organization, which need to change somehow" (Need to change in the examination system) (P2).

"If you do an information-intensive exam, they provide information to children. If you do a skill-based exam, they will teach skills to children... In other words, if an exam is measured in the university exam or high school entrance exam that measures internal skills, the whole education system adapts accordingly. If there is an exam system that requires more technology, people use more technology?" (Integrating examination system in which individual skills are measured with technology) (P2).

"We have always given priority to hardware until this time. In other words, it was one of our biggest mistakes in the FATİH Project. We first started by buying hardware. ... Yes, the hardware is important but the human resource is much more important than hardware. I mean if you cannot train your teacher, there is no benefit in getting that equipment. ... This equipment will not be even used after a certain period of time. Therefore, we are now in favor of giving priority to the teacher, teacher training, not to hardware. ... The teacher needs a lot of information if he will be a guide, that is to say, if he is going to be a leader in the classroom. So when you come to class, you can present those skills to your students or guide them on that subject. That's why we focused more on the personal development of teachers than on hardware. We said that materials

would be somehow taken care of. It can be done with cheaper systems; it can be done from internal resources. It can be taken care of from the school, or support can be obtained from parents if needed. But if you have a trained teacher, it doesn't matter. A study at school starts immediately, even without hardware. This work starts to be productive. That's why we headed there" (Paying attention to the education of the educator instead of hardware in ICT supported learning; providing trainings on the development of technology skills of the teacher in ICT supported learning; Enabling educators to guide students in ICT-supported learning) (P3).

"Now everyone is discussing EBA. ...such as content was enough, there was not any content in respected subject. Especially physical education and sports teachers for example always argue. They say there is not much content about their lesson or they cannot easily explain their lesson on EBA. Now we do not believe that very much. Actually our content is teacher. The more we manage to train the teacher, the more they will be able to create content. Because when he finds a solution in his class, he can publish and share that solution via EBA. There he can divide the class into groups. In fact, what we call EBA is process software. So, he can follow the process from start to finish. Here a class came to your hand, wants to work with that class. But in the classroom, there are students in different groups or different levels. Some go far ahead, much more successful, higher level of perception. The opposite of some does not have much attention. For example, the teacher can divide them into groups in EBA and can offer separate exercises, separate activities and examples for them. If he wants, he can give separate documents so that he can actually control an entire class at the same time. And it can provide additional material to a student whose success has been dropped, or they can get the opinion of their friends, make peer reviews. It can still be evaluated at certain times. And while doing all this, it doesn't have to be in the classroom. Lessons on EBA can be also carried at home. If he wants, he can manage lesson and students on a certain order" (Enabling educators to use training materials suitable for individual differences, to get opinions from their colleagues and to make peer evaluations with the EBA software developed by MoNE.) (K3).

Participants' views on business sector support for learning and inclusion with the use of ICT are given in Table 4.

Table 4. Participants' views on business sector support for learning and inclusion with the use of ICT

		Frequency (f)
Business sector support for learning and inclusion with the use of ICT	Determining the needs of the target audience by analyzing them	1
	Online environment design for the specified needs of the target audience	1
	EBA designed by MoNA does not support inclusive education	1
	No initiatives for inclusive education in the private sector	1
	Initiatives for a single disadvantaged group in the private sector	1
	Creating a pool of educational content for inclusive education and determining which disadvantaged groups are effective.	1
	Providing the state budget for the pool of educational content for inclusive education	1
	Teachers' willingness to use ICT	1
	MoNE's EBA allows teachers and students to use free of charge until a certain quota	1
Total		9

Participants' opinions which support Results in Table 4 about the opinions of the participants about business sector support for learning and inclusion with the use of ICT are given below:

"I mean, the target audience is important. An environment or something needs to be designed by analyzing the needs of learners" (Determining the needs of the target audience by analyzing them; Online environment design for the specified needs of the target audience) (P1).

"I think of the EBA, for example, if it is considered there? Is there an environment for different learners out there? No, I think you can have a subtitle when you need it or use a sign language. You get different options. I don't think so much in our country this is possible yet. I think

there is no environment, no tools to cover all the different individuals" (EBA designed by MoNA does not support inclusive education) (P1).

"Private sector ... Do I know? I don't think it is completely inclusive either. For example, my friend had done something for this. He had worked with them for the mentally disabled. I think there is a single target is chosen in this way. You know, it comes from one requirement, not more than one. I think it is being created. Could they provide an environment for all? I do not know. Really, designing an environment by analyzing it with different target audiences. After that, it is necessary to analyze that process and make improvements. I don't see it, frankly (Laughs)..." (No initiatives for inclusive education in the private sector; Initiatives for a single disadvantaged group in the private sector) (P1).

"The advantage of information technologies, that is, the biggest advantage of technology, is to do things that can be used repeatedly. You are making a software that software can be used repeatedly. You can try this in different groups. You can collect the results. Now you can prepare disabled or differentiated content on the same subject and apply a lot of them to large groups, and then you can understand which one is working better, which one works better in which type of person and which students are more inclined to learn. Therefore, the first thing to do is to create a pool and add as many materials and educational content as possible. Then tag them and find out which ones work best in which situations and which groups. After finding it, use it again and again. This is something to do, but it is costly to create such a large pool. It also increases the cost. Therefore, in order to bear this cost, either the demand must be high, or even if the demand is low, it must have high returns" (Creating a pool of educational content for inclusive education and determining which disadvantaged groups are effective) (P2).

"Unfortunately, there is less demand on this issue and those who have demand are not able to afford it. Therefore, it is difficult to be developed by the private sector. In such cases, the state supports it in some way as a social state. I mean either state applies for some exemptions related to this or directly allocates funds for such projects. It sounds like this would be more accurate if these two methods were developed" (Providing the state budget for the pool of educational content for inclusive education) (P2).

"The teacher needs to make an effort because, of course, there is FATİH infrastructure in our schools. So, at least we have the internet. Many, in our class... We do not have very few in our class, for example, not only in primary schools. We have smart boards, interactive boards.... So you have the chance to open it and make an event from there. He can always open EBA. Use of EBA was free up to 3GB, even some companies

were free to 6GB. So as long as the student uses EBA, internet is free..." (Teachers' willingness to use ICT; MoNE's EBA allows teachers and students to use free of charge until a certain quota) (P3).

Opinions of the participants about the innovations used in schools are given in Table 5.

Table 5. Opinions of the participants about the innovations used in schools

		Frequency (f)
Innovations Used in Schools	Events with 3D technology equipment	1
	Lack of necessary state support for the use of technological innovations in public schools	1
	Technological innovations in public schools need teachers to meet themselves or find sponsors	1
	Failure to use innovations in public schools due to teacher or school administration resisting technological developments	1
	The technological innovations spontaneously spread as a result of positive feedback.	1
	Cooperation of the private sector with MoNE in technological innovations used in the field of education	1
Total		6

Participants' opinions which supports Results in Table 5 about the Innovations Used in Schools are given below:

"3D pens, printers are out there. Private schools can buy and use those printers ... I can see that they use them. There is also a teacher at the public school.... For example, I follow. He also has some activities with these 3D pens" (Events with 3D technology equipment) (P1).

"Frankly, there are no such opportunities in the state. Teachers may want to use them, but I think they have no resources. They either need to find sponsors or reach something with their own efforts. I can say that such things are easier to access in the private sector. For example, teachers working in the east said that they had set up their own laboratories with their own efforts. They were asking from the MoNE... but they could reach such things either through the acquaintances or through the ministers" (Lack of necessary state support for the use of technological

innovations in public schools; Technological innovations in public schools need teachers to meet themselves or find sponsors) (P1).

"In other words, there is a group that insists on innovations and a group that opposes innovations that do not want to use it. There is also a group that continues to explain with their own classical methods. Obviously, when you look at an experienced mathematics teacher who has spent 30 years or so, he certainly did not want to use it. ... But novice teachers can be more interested in this kind of things or their skills may be better" (Failure to use innovations in public schools due to teacher or school administration resisting technological developments) (P1).

"Innovation is progressing in the form of diffusion. So if what you do is something that works very well, it diffuses very fast. If it is very visible, it still progresses fast. If what you're doing is obviously more beneficial from others, what you're doing is moving fast. ...In other words, if it works, it appears to be used by itself. It spreads itself" (The technological innovations spontaneously spread as a result of positive feedback) (P2).

"We actually work with many of them (Private Sector). Especially in education... Yes, they have financial resources and staff. ... Every developing technology reflects differently on education. Education is very different, so they are very supportive, that is, they support in terms of teaching. For example, when we are going to get support from outside, we rather get it from a teacher than an engineer. There's a reason. Yes, engineers are very knowledgeable. But what will my teacher need in the classroom, how will it be used? How will it become a more effective tool? Because he knows what his friend needs or what is used in classrooms. Therefore, a lot of collaboration can be done with private sector in the field of education" (Cooperation of the private sector with MoNE in technological innovations used in the field of education) (P3).

The opinions of the participants about their support for the development of ICT-related skills among the responsible persons (trainers and teachers) for the learning and inclusion process for disadvantaged groups are given in Table 6.

Table 6. The opinions of the participants about their support for the development of ICT-related skills among the responsible persons (trainers and teachers) for the learning and inclusion process for disadvantaged groups

		Frequency (f)
Support for the development of ICT-related skills among the responsible persons (trainers and teachers) for the learning and inclusion process for disadvantaged groups	Experiencing and testing the systems developed for disadvantaged groups by responsible persons	1
	Discussions on the development of ICT skills of disadvantaged groups of responsible people through digital storytelling workshops	1
	Easy to use ICT applications	1
	Presenting ICT application contents grouped according to different individual characteristics to responsible persons	1
	Providing in-service training to teachers who resist the use of technology and who have deficiencies in technology use	1
	Providing in-service training for the development of ICT-related skills of those responsible within the Ministry of National Education.	1
	Gamification of individuals' learning with the integration of technology in education	1
Total		7

Participants' opinions which supports Results in Table 6 about their support for the development of ICT-related skills among the responsible persons (trainers and teachers) for the learning and inclusion process for disadvantaged groups are given below:

"First of all, I think they have to use and experience that technology. In other words, I think that whatever we aim for the learners, what we aim to gain there, I think that teachers should have a workshop in that direction and go through the process and experience themselves" (Experiencing and testing the systems developed for disadvantaged groups by responsible persons) (P1).

"We can make it easier by implementing digital story workshops... I worked with teachers in different conditions. All of them share insights during story circle... They pour out their heart. They question the other side what they can do, they take each other's suggestions. They say the points they disagree with. In fact, the process of digitizing their stories continues in this story circle until the end of the group screening. In the sound recording ... In the process of preparing the visuals ... Although it seems a bit technical there, the teachers continue to speak in the background. And because they are warming and trusting each other more, they begin to pour, ask, and support each other. You know, in the in-group screenings, you can see their digital stories after watching them for the last time. They make comments through their stories again, and they speak out their suggestions for the future. In this way, I can say that there is a process of contributing in expressing and discussing such disadvantaged issues" (Discussions on the development of ICT skills of disadvantaged groups of responsible people through digital storytelling workshops) (P1).

"I don't have an educator background. So maybe I can just transfer my observations. Therefore, as an outsider, my observations... First of all, teachers should not be asked for anything extra. They are already Facebook users, I know Twitter users, WhatsApp users want to use products that can be used with the same logic. Otherwise, it should not be more difficult. This is a really important barrier" (Easy to use ICT applications) (P2).

"Materials that they can present in front of them must be grouped for the students who learn differently in their classes individually, In other words, without telling too much, the teacher tends to say to this group, let me give this to this group and distribute ready packages immediately. Otherwise, it is both difficult and not realistic to do anything from scratch and expect it from him" (Presenting ICT application contents grouped according to different individual characteristics to responsible persons) (P2).

"Here, in-house trainings are held. Older teachers put up more resistance in this regard. Younger teachers help them at work. They create such groups and complement teachers' technology deficiencies through in-house training. In other words, teachers continue their education in this way in schools. Students learn, on one hand, teachers learn on the other. This continues all the time" (Providing in-service training to teachers who resist the use of technology and who have deficiencies in technology use (P2).

"So we organize in-service training for them, whatever they need in different fields. Because these are Web 2.0 tools, new technologies, and

mobile uses. We explain how they adapt to them, what program they can find, how they can use this program in their class. ... There are in-class activities or classroom assessment tools such as possible to use online, they are very effective. You can gamify learning actually using digital skills" (Providing in-service training for the development of ICT-related skills of those responsible within the Ministry of National Education; gamification of individuals' learning with the integration of technology in education) (P3).

Participants' views on methods and strategies for developing open educational resources for disadvantaged groups in Turkey are given in Table 7.

Table 7. Participants' views on adopted methods and strategies for developing open educational resources for disadvantaged groups in Turkey

		Frequency (f)
Adopted methods and strategies for developing open educational resources for disadvantaged groups in Turkey	Determining the needs for disadvantaged groups	1
	Establishing infrastructures suitable for the determined needs of disadvantaged groups and making improvements according to incoming feedback	1
	Producing resources for disadvantaged groups, translating those in a foreign language to Turkish	1
	Indexing of resources prepared for disadvantaged groups for easy implementation of responsible persons	1
	Encouraging teachers to use open educational resources	1
	Publishing the content developed by teachers after editorial evaluations in EBA	1
	Designing and executing e-twinning projects by Teachers	1
	Using Web 2.0 application tools in teacher-student interaction	1
	Benefits of Teachers' use of public ICT systems for individuals to learn	1
Total		9

Participants' opinions which support Results in Table 7 on adopted methods and strategies for developing open educational resources for disadvantaged groups in Turkey are listed below:

"First of all, what kind of resources do disadvantaged groups need, these need to be determined. After it is determined, it is necessary to evaluate and improve it accordingly after providing the infrastructure" (Determining the needs for disadvantaged groups; establishing infrastructures suitable for the determined needs of disadvantaged groups and making improvements according to incoming feedback) (P1).

"There are a lot of materials, but most of them are in foreign languages. ...and there is a lot of information pollution. In other words, it is difficult for the teacher to find and select what is useful for him and pick them up. So if the indexes are prepared or something national ... Things that the Ministry of National Education or Civil Society Organizations may be preparing ... So, if this is the process, it is more efficient if catalogs are indexed to those who need to be presented to the students who have the specific problem. Because it is difficult for teachers to collect, find, try after that and see the result" (Producing resources for disadvantaged groups, translating those in a foreign language to Turkish; Indexing of resources prepared for disadvantaged groups for easy implementation of responsible persons) (P2).

"In other words, our job is to make use of these resources (by teachers). We encourage them. For example, we recommend our teachers to prepare lessons if they have different knowledge, if they have different areas of work. Here we even try to help with that. If you have such content, digitize it. We announce our platform, even if you want we publish it for you. This is the way EBA works. So, if it developed by a teacher this content can be shared over EBA. Of course, there's an editor. Editors evaluate. If appropriate, that content, for all of Turkey..." (Encouraging teachers to use open educational resources; Publishing the content developed by teachers after editorial evaluations in EBA) (P3).

"Our teachers are very active in e-Twinning. Even now as we know that most e-twinning project applications are from Turkey. So, they came to that point, actually. There, at least among themselves, they can share resources among teachers. I mean, I prepared something like that, so you can use it in your class if you want..." (Designing and executing e-twinning projects by Teachers) (P3).

"Facebook is here, WhatsApp, Messenger are also used very effectively. But of course, these are closed systems... It is much more useful if there is actually a system that everyone can see" (Using Web 2.0 appli-

cation tools in teacher-student interaction; Benefits of Teachers' use of public ICT systems for individuals to learn) (K3).

The opinions of the participants about the use of open education resources to cooperate with disadvantaged individuals are given in Table 8.

Table 8. The opinions of the participants about the use of open education resources to cooperate with disadvantaged individuals

		Frequency (f)
Use of open education resources to cooperate with disadvantaged individuals	Determination of accessibility to technology by disadvantaged groups	1
	Designing systems suitable for technology and technology literacy skills of disadvantaged groups	1
	Providing technology literacy training for disadvantaged groups	1
	Guidelines for disadvantaged groups to gain awareness of efficient use of open education resources	1
	MoNE's General Directorate of Lifelong Education is in preparation of learning environment design for everyone including disadvantaged groups and this system will be published to EBA when it is ready.	1
Total		5

Participants' opinions which support results in Table 8 on use of open education resources to cooperate with disadvantaged individuals are listed below:

"At first, do they have access to a technology, ownership? In other words, this has to be looked at first. So unless it is, what you do can go to waste. ...this study can be done first. What is the state of having technology? ...what do they use more? Systems can be developed accordingly. You know, they only have a phone in their hands. If they don't have a computer, they won't be able to reach anything again. Do they use mobile, tablet or something? Do they have access to Internet infrastructures if they have computers? These have to be questioned first" (Determination of accessibility to technology by disadvantaged groups) (P1).

"First of all, it is a mobile, tablet, desktop, what kind of technology needs exists and system design for them... What kind of literacy skills they have when designing the system as well? These are important. They may have a low level of use, and then you designed it, you offered the technologies, but if they don't have the skills, they may be also trained" (Designing systems suitable for technology and technology literacy skills of disadvantaged groups; providing technology literacy training for disadvantaged groups) (P1).

"When it comes to disadvantaged groups, those groups must first know what will happen after they receive this training. Now are they aware of this? Awareness should be created so that they have the knowledge that if they reach an education like this, the result will make such a difference. That awareness is very low right now. Maybe not even. Only after this difference has occurred can one talk about its methods. How can be done more efficiently? Now, perhaps this awareness needs to be increased the most... Now, first of all, he should have path to go in front of him, and as a result of this path, he should say, see, and know that he should try to go through this path" (Guidelines for disadvantaged groups to gain awareness of efficient use of open education resources) (P2).

"The General Directorate of Lifelong Education has actually prepared a portal called open schools, open high school. In fact, it was still prepared, I do not know its final status at the moment, but they were preparing all the course content for those students. In other words, when we talk about lifelong learning, there are elderly people, young people, other disadvantaged groups, refugees, immigrants or people who need special education. All of these can be given as part of lifelong education. And as far as I know they are about to include them in EBA right now. They will share their lifelong content through EBA. It will be published over EBA from now on. Students can access EBA in any way. Including students in the private school" (MoNE's General Directorate of Lifelong Education is in preparation of learning environment design for everyone including disadvantaged groups and this system will be published to EBA when it is ready.) (P3).

The opinions of the participants about the state support for the use of ICT in the learning and inclusion of disadvantaged groups are given in Table 9.

Table 9. Opinions of the participants about the state support for the use of ICT in the learning and inclusion of disadvantaged groups

		Frequency (f)
State support for the use of ICT in the learning and inclusion of disadvantaged groups	Fatih Project carried out by the Ministry of National Education, it does not cause the desired targets to be achieved without training.	1
	Preparation and presentation of activities for the mother tongue of immigrants, one of the disadvantaged groups	1
	Planning and implementing inclusive education by taking advantage of the opportunities offered by technology	1
	Design of distance education system and exams for equal opportunity in education for disadvantaged groups	1
	Determination of interested teachers as leading teachers and leading teachers to improve their educational content by using ICTs and guide other teachers	1
	Development of educational content used by ICTs through design-skill workshops	1
	Realization of the Digital Wings Project with the cooperation of MoNE and private sector	1
	Collaboration between MoNE and universities to ensure that pre-service teachers receive trainings with improved technological skills	1
	Training pre-service teachers in accordance with 21st century skills	1
Total		9

Participants' opinions which support results in Table 9 on state support for the use of ICT in the learning and inclusion of disadvantaged groups are listed below:

"FATİH Project did not achieve much success, so it did not provide a full equality of opportunity anywhere in Turkey. Tablets were also distributed, but to what extent students could use them. .. They distributed the technologies to the classes, but they were not full. ... It would have been better if they were made available them first. How ready the teachers were for this? In fact, we can say that it was something that was implemented without preparation" (FATIH Project carried out by the Ministry of National Education, it does not cause the desired targets to be achieved without training) (P1).

"Either Syrians, so when we think about it, children have language problems. How do they understand, can they follow at the same level? How true is it that they are presented to our students in the same way as what is offered to them? I also think that events should be organized for them" (Preparation and presentation of activities for the mother tongue of immigrants, one of the disadvantaged groups) (P1).

"At that point, there are many opportunities that something different technology offers, but it is important that it is well managed, planned and implemented" (Planning and implementing inclusive education by taking advantage of the opportunities offered by technology) (P1).

"Normally, a person with a physical disability attending school every day is a process involving serious overtime and serious workload difficulties. This can be facilitated by distance education. The first thing is this distance education can be done. Secondly, exams such as exams are different for the visually impaired and the hearing-impaired are different. Differentiated exams are held in these kinds of things. It is wrong to wait for someone with a visual disability to make a question with shapes. Here comes something else. You make it feasible thanks to information technologies. In other words, you can prepare a fair exam system to be more equal" (Design of distance education system and exams for equal opportunity in education for disadvantaged groups) (P2).

"In the 2023 Vision Document, there is actually a concept that we call a leading teacher. Especially in the field of information technologies ... It says that teachers in schools should take teachers who are enthusiastic about this subject to leadership. There is a part to let them lead their colleagues and to ensure that these contents are used, expanded and multiplied. In fact, there were design-skill workshops in the Vision Plan. In fact, the Ministry has another project for the field of informatics, teaching or digital wings, and the Ministry is trying to carry them out. In other words, collaboration with universities should be done in this field. So what skills do we want? What skills do universities provide? Because you usually gain most of these skills in a school environment. You don't come here with the skill you got at the university. But should it be? In

particular, informatics should use it at that level, the engineer should use it at that level, and the teacher should use it at that level. But what is it, as much as it will adapt to your profession ... So maybe it is the only part we passed. But is there such a policy at universities? I do not know this. But it should be. Especially in the field of educational technologies, in every branch" (Determination of interested teachers as leading teachers and leading teachers to improve their educational content by using ICTs and guide other teachers; Development of educational content used by ICTs through design-skill workshops; Realization of the Digital Wings Project with the cooperation of MoNE and private sector; Collaboration between MoNE and universities to ensure that pre-service teachers receive trainings with improved technological skills) (P3).

"We do the cooperation between the University and the Ministry of National Education on the basis of projects. In fact, we are working with the university in a project that we wrote and we exchange views. But, of course, this should become a policy, that is, a strategy. Now people with skills are adapting what they call 21st century skills, deep learning at work, problem solving at work. In fact, individuals who have these skills should be trained in universities as well as in our schools" (Collaboration between MoNE and universities to ensure that pre-service teachers receive trainings with improved technological skills; Training pre-service teachers in accordance with 21st century skills) (P3).

Discussions

Results of the participants' perspectives on mostly used ICT-Based Educational Solutions by teachers and trainers in Turkey given below:

- Encouraging the use of smart boards, EBA and internet infrastructure of not only young teachers but all teachers,
- Some applications for coding,
- Applications / systems to alleviate the workload of teachers and trainers,
- Trainers and teachers completing their deficiencies by getting basic information literacy training,
- Training of computer and instructional technology teachers to learn new technology applications.

Although technology integration in education is shaped by taking students to the center, we can say that teachers have also an important role

in this process. Although teachers' perceptions, attitudes, knowledge, experience and skills towards technology are significantly influential in ICT use, results show that teachers appear to have some shortcomings at this point (Karaca, 2011; Chen, 2008). The ability and competence of the teacher to use technology is directly related to the technology integration process (Inan & Lowther, 2009; Gorder, 2008; Vannatta & Fordham, 2004). Technological experiences of teachers affect their perception and expectations of using technology in education as well as their successful technology integration (Krause, 2010). The positive experiences related to technology may lead to the development of a positive perception towards technology or the lack of experience of the technology leads to a negative attitude towards technology (Reynolds & Rucker, 2002). However, it can be said that teachers and students should use technology regularly in a successful technology integration. In addition, young teachers' perception of technology integration and use of technology is higher than older teachers (Gorder, 2008). It is stated that this result is related to the fact that new teachers are more close to technology culture and they have benefited from technology in their pre-service education. In his research, Hsu (2010) stated that teachers with a high level of technology use knowledge may have a high level of technology integration competencies. In the study carried out by Sang, Valcke, Van Braak & Tondeur (2010), it was found that although the constructivist approach was aimed in teacher education in Vietnam, the use of ICT applications was limited and mostly traditional teaching practices were used. As a reason, it was shown that educators had low ICT skills. In the research conducted by Hutchison and Reinking (2011) with literature teachers, it was found that the literature course remained low in the integration of the curriculum with technology and this situation prevented the integration of the content of the course with technology. It was determined by Bouhnik and Deshen (2014) that WhatsApp groups were used as a platform for teachers to communicate with students, to increase social interaction, to encourage sharing among students and to learn.

Participants' opinions about the biggest obstacles in the implementation of modern ICT-based solutions are given below:

- Lack of infrastructure and financial support in public schools,
- Teachers feeling anxiety to complete education programs in public schools,
- Hardware access barrier in public schools,
- Regional hardware limitation in public schools,

- Lesser obstacles in the implementation of ICT practices of private schools than public schools,

- ICT applications that will cause teachers to spend extra time in private schools,

- School principals do not want to send teachers to courses opened within the Ministry of National Education (MoNE).

- School principals prevent teachers' participation in courses because of the statement in the "Teacher Training Regulation" of MoNE, which mentions that teachers can participate in the courses opened within the MEB, in case teachers do not disrupt their lessons.

Access to technology, availability of technology or resources are another prerequisite for technology integration and important factors that prevent integration (Inan & Lowther, 2009; Chen, 2008; Hohlfeld, Ritzhaupt, Barron & Kemker, 2008; Vanatta & Fordam, 2004). Teachers want to know why they need to integrate technology into the teaching process and how to do it. It is seen that teachers have basic technology usage knowledge, but they do not know how to integrate them into the education process and they do not have sufficient knowledge and skills regarding technology integration (Eyyam, Meneviş & Doğruer, 2011; Chen, Lim & Tan, 2010; 96,97,98). Therefore, pedagogical knowledge and skills that teachers have to acquire are also within the scope of technology integration competence (Gorder, 2008). Teachers have trouble finding time for the acquisition of knowledge and skills, following new technologies and adapting to educational environments. The problem of time is seen an important factor in both obtaining (selecting and developing) material and the planning and designing of the integration process. However, even though teachers have the ability to use technology and have sufficient time, they may not be able to integrate technology into the education process (Bauer & Kenton, 2005). At this point, it is clear that "knowledge of how to integrate technology effectively into education" and the use of technology are two effective points.

Although teachers' taking in-service courses and seminars in the field of technology integration and enabling specialists in the field to provide seminars in schools should be among the important responsibilities of school administrators (Gülünç, 2017), this might not be the case in practice. One of the most important obstacles to the effective integration of technology into learning-teaching processes is that teachers, as practitioners, do not have a significant experience in how to use which tools to perform technology-based practices. In the research conducted by Akarawang, Kidrakran & Nuangchalerm (2015), it was found that it is necessary to integrate ICT into education in order for teachers to obtain

better learning experience and skills. Since the existing education system in schools does not allow the use of the system in which ICT is integrated, it is stated that it is necessary to develop an education program in which ICT is integrated with teachers, blended education models (traditional education approach and internet-based education).

Results of participants views on the use of hardware and human potential in Turkey to further improve the effectiveness of ICT-supported learning is given below:

- Providing in-service training for the target group
- Emphasis on the use of technology as a tool within the scope of the trainings provide,
- Need to change in the examination system,
- Integrating examination system in which individual skills are measured with technology,
- Paying attention to the education of the educator instead of hardware in ICT supported learning,
- Providing trainings on the development of technology skills of the teacher in ICT supported learning,
- Enabling educators to guide students in ICT-supported learning,
- Enabling educators to use training materials suitable for individual differences, to get opinions from their colleagues and to make peer evaluations with the EBA software developed by MoNE.

When technology integration is realized within the framework of meaningful activities in educational processes, it can be stated that they have significant benefits to learning processes and outcomes. Otherwise, it can be said that only equipment of educational environments with technology or the use of these technologies with focus on teacher or content will have limited contribution to learning-teaching processes. In summary, the most important determinant of the efficiency of technology integration in education depends on the level of learners' involvement in the learning process (Dexter, Anderson & Becker, 1999). In the study conducted by Wu, Pan, & Yuan (2017), it was determined that the integration of ICT tools in education is effective in student-student interaction, teachers 'guidance and students' profession in the future.

In the research conducted by Sargezi, Esmaeili, Mirgol, Moghaddam, Sargezi & Komak (2020), it was found that the use of information and communication technologies had a positive effect between the cognitive empowerment and the effectiveness of instructional performance.

Results for the Participants' views on business sector support for learning and inclusion with the use of ICT is given below:

- Determining the needs of the target audience by analyzing them,
- Online environment design for the specified needs of the target audience,
- EBA designed by MoNA does not support inclusive education,
- No initiatives for inclusive education in the private sector,
- Initiatives for a single disadvantaged group in the private sector,
- Creating a pool of educational content for inclusive education and determining which disadvantaged groups are effective,
- Providing the state budget for the pool of educational content for inclusive education,
- Teachers' willingness to use ICT,
- MoNE's EBA allows teachers and students to use free of charge until a certain quota.

Many students who need special education cannot fully benefit from a standard education program since they do not have the conditions to participate in a standard classroom environment. Therefore, computer-based technologies can play an important role in inclusive education for these students (Hasselbring & Glaser, 2000). Computer and internet technologies can be used effectively to ensure that students in need of special education achieve equal conditions with their normal peers in terms of access to information. In this context, the use of technology in special education covers a wide range of applications; examples of these applications are assistive technology, adaptive technologies and the basic use of computers for instruction (Stanford, Crowe & Flice, 2010). In the research conducted by Stone, Mills & Saggers (2019) within the scope of special education, online games were used in the education of students with autism spectrum disorders.

As a result of the research, it was determined that multi-player online games made important contributions in addressing students' interests in order to support their skills in initiating and maintaining social interaction in inclusive educational environments. In this context, technological tools and digital products can be used in the learning-teaching processes organized for students who need special education. In the related literature, Leung and Mak (2010) stated that teachers' basic and incomplete understanding was found in the study in which the competencies of the teachers were examined. However, they concluded that variables such as subject and age taught are not effective on teacher attitudes, and that the variable of experience in teaching positively affects the attitude of the teacher. In addition, as a result study reveals that teachers wanted to receive education about inclusive education however could not realize because of the high workload and the high level of procedural works in the study, of De Boera, Pijlb & Minnaerta (2011) in which the attitudes towards classroom teachers' practices of inclusive education were examined, it was found that teachers generally displayed neutral or negative attitudes. Forlin & Chambers (2011) conducted a research aiming at evaluation of pre-service teachers' perceptions regarding their preparedness for inclusion. The study found that increasing knowledge about legislation and policy related to inclusion, and improving levels of confidence in becoming inclusive teachers, did not likewise address their concerns, or perceived stress, about having students with disabilities in their classes.

Results of the opinions of the participants about the innovations used in schools are given below:

- Events with 3D technology equipment,

- Lack of necessary state support for the use of technological innovations in public schools,

- Technological innovations in public schools need teachers to meet themselves or find sponsors,

- Failure to use innovations in public schools due to teacher or school administration resisting technological developments,

- The technological innovations spontaneously spread as a result of positive feedback,

- Cooperation of the private sector with MoNE in technological innovations used in the field of education.

It is considered important to use teaching activities that will activate students' visual and intellectual structures, while presenting information that is abstract and difficult to design in mind. In this context, it is stated that three-dimensional teaching materials can be used (Kahraman & Demir, 2011). Three-dimensional teaching materials are also included in research on inclusive education.

For example, in a study by Jager (2017), in which they examined three-dimensional images of the heart, the result showed that 3D animations improved teacher student's understanding of concepts regardless of the learning barriers they encountered. They also agreed that their attention span improved, they were more interested in the topic, developed a deeper understanding of the content, were actively involved in the lesson and tended to ask more complex questions. From this point of view, it can be said that three-dimensional digital materials can be used as an effective tool in differentiating education according to the learning characteristics of the students in inclusive education and thus, all students may benefit most from the education given regardless of their differences.

Results of the opinions of the participants about their support for the development of ICT-related skills among the responsible persons (trainers and teachers) for the learning and inclusion process for disadvantaged groups are given below:

- Experiencing and testing the systems developed for disadvantaged groups by responsible persons,
- Discussions on the development of ICT skills of disadvantaged groups of responsible people through digital storytelling workshops,
- Easy to use ICT applications,
- Presenting ICT application contents grouped according to different individual characteristics to responsible persons,
- Providing in-service training to teachers who resist the use of technology and who have deficiencies in technology use,
- Providing in-service training for the development of ICT-related skills of those responsible within the Ministry of National Education,
- Gamification of individuals' learning with the integration of technology in education.

When digital storytelling is considered in terms of learner participation, it enables learners to take an active role in terms of planning, managing and executing their own learning process, enabling them to have rich experiences. It can be stated that these learning experiences are effective in making the attendance easier and more effective (Olokunde & Lawson, 2016; Wang & Zhan, 2010). At this point, digital storytelling can be described as an important example of significant technology integration, both in terms of its learner-centered structure and creating significant opportunities for teachers to use technology more effectively in their classrooms. The use of gamification in education is important to internalize learning and teaching processes, to achieve meaningful and deep learning, and to provide motivation and dedication (Sezgin, Bozkurt, Yılmaz, & Linden, 2018). Gamification is a powerful tool in terms of attracting students' attention, actively participating in activities, creating behavior change. Gamification is considered as a powerful tool to attract students' attention and ensure their active participation in activities (Kim, 2015).

Results of the Participants' views on adopted methods and strategies for developing open educational resources for disadvantaged groups in Turkey are given below:

- Determining the needs for disadvantaged groups
- Establishing infrastructures suitable for the determined needs of disadvantaged groups and making improvements according to incoming feedback
- Producing resources for disadvantaged groups, translating those in a foreign language to Turkish
- Indexing of resources prepared for disadvantaged groups for easy implementation of responsible persons
- Encouraging teachers to use open educational resources
- Publishing the content developed by teachers after editorial evaluations in EBA
- Designing and executing e-twinning projects by Teachers
- Using Web 2.0 application tools in teacher-student interaction
- Benefits of Teachers' use of public ICT systems for individuals to learn.

Ministry of National Education (2013) declared the vision for information technology in the education system as

"To integrate the education system with advanced technologies, to support with innovations, to continuously develop by measuring and evaluating, to provide student-centered and project-based education by using information technologies".

When the vision for ICT in education in Turkey carefully examined it is clear that how much importance given to the teachers. In the Ministry of National Education (2018) curriculum, teacher candidates were expected to be able to use technology effectively as part of the competence field named "digital competence".

Accordingly, digital competence, covers the safe and critical use of information and communication technologies for work life, daily life and communication. This competence is supported through basic skills such as access to information and the use of computers for the evaluation, storage, production, presentation and exchange of information, as well as participation in common networks and communication through the Internet. In this context, it is seen that MONE explicitly strives for educators to use technology effectively. It can be said that teachers who use information technologies in classroom applications should be a role model for their students, especially since teachers are an important stakeholder in terms of being the practitioners of technology integration in classroom learning and teaching activities.

Results of the opinions of the participants about the use of open education resources to cooperate with disadvantaged individuals are given below:

- Determination of accessibility to technology by disadvantaged groups,
- Designing systems suitable for technology and technology literacy skills of disadvantaged groups,
- Providing technology literacy training for disadvantaged groups,
- Guidelines for disadvantaged groups to gain awareness of efficient use of open education resources,
- MoNE's General Directorate of Lifelong Education is in preparation of learning environment design for everyone including disadvantaged groups and this system will be published to EBA when it is ready.

It can be said, in today's conditions, that teachers' job is quite challenging, considering that students, who are called digital generations, are familiar with technology and eager to use technology effectively. The first thing that comes to mind when it comes to enriching teaching and using tools and equipment is the integration of technology into education and the effective use of information technologies in lessons. However, technology cannot be integrated into teaching with just simply adding new tools and materials in teaching. It is very important for educators to use pedagogy and content knowledge together for technology integration.

Results of opinions of the participants about the state support for the use of ICT in the learning and inclusion of disadvantaged groups are given below:

- Fatih Project carried out by the Ministry of National Education, it does not cause the desired targets to be achieved without training,

- Preparation and presentation of activities for the mother tongue of immigrants, one of the disadvantaged groups,

- Planning and implementing inclusive education by taking advantage of the opportunities offered by technology,

- Design of distance education system and exams for equal opportunity in education for disadvantaged groups,

- Determination of interested teachers as leading teachers and leading teachers to improve their educational content by using ICTs and guide other teachers,

- Development of educational content used by ICTs through design-skill workshops,

- Realization of the Digital Wings Project with the cooperation of MoNE and private sector,

- Collaboration between MoNE and universities to ensure that pre-service teachers receive trainings with improved technological skills,

- Training pre-service teachers in accordance with 21st century skills.

Undoubtedly, the process of technology integration is new in our country, as in many societies of the world. In this context, an effective collaboration should be established between education faculties and primary, secondary and high school levels. It can be said that it is important

for pre-service teachers to graduate from education faculties with "technology integration skill and competence" For this, it may be suggested to open related elective or compulsory courses so that pre-service teachers can obtain the theoretical and practical competence regarding technology integration within the scope of these related courses. Inclusion of technology into every area of our lives has made a transformation in education system. The ability to establish the bridge between educational levels depends on the adaptation of the society to this transformation process as much as possible. Therefore, it can be said that it is important to support teachers with in-service trainings during this adaptation process (Gülünç, 2017). However, in-service training alone is temporary and may not be an effective solution, and the competence regarding technology integration should be gained especially in the pre-service period.

Another stakeholder that school administrators need to collaborate and interact with is information technology teachers. Information technology teachers are seen as technology leaders just like school administrators. Information technology teachers have a mission to support and guide other branch teachers, especially teachers in integrating technology into their fields (Gülünç, 2017). However, in order to fulfill this mission successfully, it is very important for provide a good education in their pre-service education. Cooperation with stakeholders and scientific processes should be taken into consideration while developing training policies regarding the technology integration process; because society is affected by education policies in both short and long term.

Education policies need to be regulated quickly and effectively, taking into account the integration process, implementing new paradigms suitable for technology integration, and reorganizing the curriculum in accordance with technology integration. Education politicians have important duties in technology integration, especially in the meticulous execution of the "technology planning" process. Information activities should be carried out to the relevant people and the society on many topics related to technology such as the contributions of technology in educational environments, true and safe use of technology, scope and limits of technology use.

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Challenges of Information and Communication Technologies (ICT) in education from the perspective of experts in Uruguay

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Abstract

This study addresses the topic of Information and Communication Technologies (ICT) in education, in Uruguay, from the perspective of three experts from teacher education and training centers, University of the Republic and Plan Ceibal. This investigation is part of a research agenda of the Smart Ecosystems for Learning and Inclusion (SELI) project (ERANet17/ICT-0076 SELI. http://project-seli.herokuapp.com/). Respondents were selected based on the following sampling criteria: they hold positions in the Uruguayan educational system, in educational management, program implementation, teacher education and/or research. They are recognized in the Uruguayan context for their knowledge or achievements in these areas, and they are currently part of the institutional display of public formal education. A qualitative approach with structured questionnaires was applied. Interviews focused on challenges of digital literacy, integration of ICT to the educational system and digital inclusion. Three dimensions are addressed in content analysis: ICT availability, implementation strategies and policies developed. Respondents seem to agree on some opinions: great achievements in terms of overcoming digital exclusion are acknowledged, although all respondents agree that there is still room for further improvement. They believe that effectiveness in technology integration is tied to teacher involvement, collaborative work, sharing and building community. Another core shared idea is that innovation resides in what people do as they appropriate technology and not in the technology itself.

Introduction

As these lines are written, the world is undergoing the Coronavirus crisis, an event with huge impacts at all levels. Educational systems of the world take quick actions to shift their educational processes to the virtual world, and teachers, experts in educational technology and teacher educators, joggle multiple balls in the air in an effort to design and implement overnight solutions to teach online or get as close as possible to that notion. It seems like a particularly sensitive moment to think of educational technologies in our country. Massive empirical data show how challenging and demanding the task of integrating technology to education can be.

Evidently, even overnight solutions, based on emergent and urgent needs, cannot exist without considering at least the following: a) technological infrastructures, devices and tools, b) pedagogical foundations and implications for the integration of technology, c) demands to implementation processes. Also, when time comes for reflection, overwhelming implications in terms of the underpinning principles that support choices made, would also need to be considered.

It is in this context, that this topic is addressed. This work is part of the second year of the SELI project (ERANet17/ICT-0076 SELI. http://project-seli.herokuapp.com/). The purpose of the study is to answer the following research questions, in each of the participating countries: What ICT-based solutions are most frequently and most effectively used by trainers and teachers? What is the greatest obstacle to introduction of ICT-based solutions? How can we use technical and human potential to further increase the effectiveness of ICT-supported education? How does the business sector support ICT-based learning and integration? Which innovations can be considered significant?

Methodology

Three interviews were made between January and March of 2020. The three respondents were selected based on the following sampling criteria: they hold positions in the Uruguayan educational system, in educational management, program implementation, teacher education and/or research. They are recognized in the Uruguayan context for their knowledge or achievements in these areas, and they are currently part of the institutional display of public formal education. Since they have been selected as qualified informants due to the prominent positions they hold and their relevance and visibility in the Uruguayan educational system, anonymity was neither an adequate option, nor a possible one. Inter-

viewees are identified with their names and they have read and agreed to the publication of this paper.

Each open interview lasted approximately one hour and it was based on a guideline with the following set of questions:

1) What ICT-based solutions do trainers and teachers apply the most in their educational activities in our country? What worked the best and why?

2) What is the biggest barrier to the implementation of the modern ICT-based solutions in our country?

3) How can we use the hardware and human potential of our country to further increase the effectiveness of ICT-supported learning?

4) Which innovations can be considered significant?

5) How does the business sector support ICT-based learning and integration?

Interviews were recorded, transcribed and coded using Qode, an open application tool for qualitative content analysis and data visualization[1].

The variables analyzed in reference to challenges of digital literacy, integration of ICT to the educational system and digital inclusion are shown in Table 1:

[1] https://qodeapp.herokuapp.com/

Table 1: Variables and dimensions analyzed in the interviews

technical resources and devices used (infrastructure)	internet access appropriate equipment
software solutions	proprietary software open— sources solutions
institutional barriers and obstacles	teacher's promotion system curriculum and curricular changes role of technologies in the curriculum
other barriers and obstacles	practical obstacles cultural barriers
the teacher	teacher's reactions and attitude (openness vs. resistance, frustration, cooperation, etc.) teacher's profile digital literacy (including safety, personal data and knowledge of licenses)
implementation strategies	plans for implementation innovation processes territory
institutional policies	The State and its public policies choices and principles business companies corporate social responsibility
inclusion	open access resources e-learning challenges vulnerable groups digital inclusion

It is important that the limitations of this research be clarified. The study is based on three interviews of national referents in the area addressed. They have been selected as qualified informants considering both their key positions in nation-wide relevant institutions that display public policies and their knowledge of the subject matter, supported by experience and research. However, this sample of referents by no means intends to be a representative sample that would account for all educational policies in reference to education and technology in Uruguay. Referents' accounts, perceptions and opinions, have individual value in as much as they are provided by subjects who have witnessed, led and studied some of the most influential policies in the area. Although the three of them work with teachers, they do not represent the opinion or perceptions of Uruguayan teachers in general, nor do they provide an evaluation of actions implemented in the country in teacher development towards ICT integration. In that sense, the value of this work is to provide initial data as an exploratory study of a field that is both vast and complex: challenges of ICT in education in Uruguay. It is an opportunity to identify challenges and issues that will require further studies. It also

provides an opportunity to develop hypotheses about ICT and education policies implementations and results.

Background information

The educational system in Uruguay is organized in subsystems, centralized by the National Association of Public Education (ANEP), an autonomous entity, responsible for the planning, management and administration of public education in Uruguay. It comprises pre-school, elementary, secondary, technical schools and part of the higher education programs offered in the country. There are two public universities: University of the Republic (UDELAR), which is also autonomous in its governance and it has 77% of university students of the country (MEC, 2017). The other is Technological University (UTEC), created in 2012 and active since 2013. Pre-service teacher education in Uruguay is under the responsibility of the Education Training Council (Consejo de Formación en Educación, CFE) which is part of ANEP. The CFE is in charge of teacher education and training of school teachers, highschool teachers, teachers at technical schools and social educators. All these careers are organized in a variety of institutions created at different historical and political times (Tomczyk et al. 2019). Even if these institutes provide a higher education degree, none of them has a university status, but they have signed agreements with UDELAR and other universities for cooperation, research activities and the development of postgraduate study programs.

Plan Ceibal, a connectivity plan, implemented in 2007 following the "one laptop per child" model, was created with the objective of introducing ICT in public education at primary and secondary public schools. It mainly started as a digital inclusion plan, rather than as a teacher development or ICT integration to teaching program. Plan Ceibal was implemented as a presidential project, led by the Technological Laboratory of Uruguay. (LATU), which has been in charge of definition and implementation policies (Severin, 2016). The central coordination and implementation of Plan Ceibal is carried out by Ceibal Center. It is directed by a board whose members are the President of the Center, who is a representative of the Executive Power, a representative of the Ministry of Education, a representative of ANEP and a representative of the Ministry of Economy and Finances.

As for formal education teaching practices, all systems develop face to face educational models with the integration of technology in a variety of technology enhanced learning models. Hybrid and blended teaching only take place in some of the higher education teacher training programs. This model has become particularly important in the interior of the country, due to its high demand among students. By the end of January 2020,

the demand for hybrid teacher training programs had doubled in reference to previous years. Distance education has not been implemented in formal Uruguayan education, except for some attempts to virtualize teaching and learning processes, which have taken place throughout the past two weeks, due to the extraordinary contingency plan carried out as a consequence of the coronavirus spread.

Three referents were interviewed, Claudia Brovetto from Pan Ceibal, Virginia Rodés from University of the Republic and Enzo Puglia from the Teacher Education and Training Centers. The following information about these institutions and particularly some of their plans and programs, will provide necessary background about the issues addressed by the respondents.

Plan Ceibal has been developed throughout the last ten years, in such a way that today it encompasses a variety of programs. Among these programs, there are: Ceibal in English, Laboratory of Digital Technology, Youths into Programming, Red Global de Aprendizajes -part of the global alliance called New Pedagogies for Deep Learning (NPDL)- and the systematic use of platforms CREA (Learning Management System on Schoology™) for curricular classes and PAM (the adaptive learning system for maths Bettermarks™). Plan Ceibal also facilitates the availability of devices to pre-service teachers in their last years of education.

Claudia Brovetto, from Plan Ceibal is a Linguist, with an MSc and a PhD in Linguistics and a background in research and in educational management. She is the Manager of two main educational programs: Red Global de Aprendizaje (RGA) which is the Uruguayan name for the program New Pedagogies for Deep Learning network of countries, and Ceibal en Inglés (CI). She has been working in Plan Ceibal since 2011.

In the University of the Republic, ICT related policies in reference to higher education teaching practices, is the responsibility of the Virtual Learning Environment Program (ProEVA), coordinated by the Department of technological and Academic Support (Departamento de Apoyo Técnico Académico, DATA), which is part of the Educational Commission (Comisión Sectorial de la Enseñanza, CSE). This program has promoted the use of open licensing, open and free (free as in freedom) software, inspired in the principles of accessibility, lifelong learning and open education. The Moodle platform has been used since 2008, as the principal component of the open digital ecosystem developed and managed by ProEVa (Virtual Environments Program).

Virginia Rodés is a graduate in Communication Sciences, she holds a MSc. in Higher Education Teaching and a PhD in Equity in Innovation and

Education. She is currently an Associate Professor in the DATA, UDELAR. She is in charge of developing institutional policies in reference to implementation and teacher training and use of technologies at university level. She is also a researcher and co-founder and coordinator of Núcleo REAA, a group of interdisciplinary studies in Open and Accessible Educational Resources.

In reference to pre-service teacher education and its approach to technology, the Department of Digital Technologies and Teacher Education was created in 2016, with the objective of coordinating the integration of digital technologies in teacher education and training programs. The task was to organize and manage technological media and human resources, develop research and take teaching initiatives in the whole country.

Enzo Puglia, from the Department of Digital Technologies and Teacher Training (Departamento de Tecnologías Digitales y Formación en Educación Del CFE) is a graduate elementary school teacher, with a degree in Education Sciences and a MSc. in Education and postgraduate studies in Education and Technologies. He is the general coordinator of that department, and is responsible for teacher training programs at the level of primary and secondary school, technical schools, social educators and preschool teachers.

Results

What follows is an analysis of the content of the interviews, organized in three general aspects that allow the composition of a unified perspective of a process that is complex, to say the least. The way ICT has been integrated into educational processes in Uruguay is currently the result of an uneven development, which involves a variety of social actors and institutions, in the context of a complex governance structure, unfolding with different timing and pace.

The option has been to identify the following three components that intend to build the general picture: ICT availability, ICT implementation and ICT policies. The first one refers to the infrastructure the country counts on, in terms of connectivity, technical resources, devices used and software choices made. The second, refers to plans for implementation, choices made in terms of steps, strategies and programs developed to install and deploy ICT for education. The third, refers to the policies, understood as value-oriented institutional choices that ponder political consequences.

Information and communication technologies available: connectivity, technological resources and software

All three respondents say that there is an infrastructure that provides the technology for digital inclusion, broadly speaking, both in terms of connectivity and in terms of technical resources available in order to access the Internet and work online. However, all of them consider that there is still room for improvement in terms of individual accessibility. "... the digital divide has not been breached, but it has been overcome to a great extent, in terms of devices and connectivity" says Enzo Puglia.

In pre-service teacher education, needs seem to have been considered, from the point of view of institutionally provided technology. "In the majority of the centers there are multimedia devices, TV sets, audio equipment, rooms with more or less updated PCs ... and there are devices provided by CFE and by Ceibal", says Puglia. Also there is other equipment used to support specific career needs, such as robots and sensors.

On a more analytic perspective, considering pre-service teachers, there are 32 teacher training and education centers in the country. Puglia states that it is a varied universe, in terms of equipment maintenance, upgrading of equipment, connectivity, building infrastructure, for example. Also, if accessibility is considered exclusively from the point of view of the individual and his or her own equipment, some students may have access exclusively from their cellphones, in case they are away from their institutions.

Brovetto, from Plan Ceibal states that "Before Plan Ceibal, only one fifth of Uruguayan families had a computer at home" She states that "Plan Ceibal provides everything to schools: connectivity, hardware, software, teacher training and evaluation" Talking about technical resources for educational solutions, she concludes that Ceibal has provided "solutions to problems that will not be solved without technology" Technology, -meaning hardware, software and communications- was of relevant importance, for example, to reach all students with English classes, regardless of the availability of human resources -teachers of English— on site. Ceibal introduced videoconferencing and today there are classes with distant teachers of English at 70% of rural schools. Brovetto explains: "At the same time Uruguay was investing in fibre optic and Ceibal was introducing video conferences and facilities in all schools".

Virginia Rodés, from UDELAR, points out that "Uruguay has a lot of technological solutions" and she asserts "Technology, there is plenty" She believes that Uruguay reaches a high level of both technological and human resources. But Rodés is careful to signal that the software choices

made respond to both open source "Practically everybody uses Moodle" and proprietary, such as Schoology™, promoted by Plan Ceibal.

ICT implementation: institutional strategies and programs

When it comes to the implementation of ICT, it is necessary to highlight the fact that there are a variety of institutions involved in the scope of the three interviewed referents. This implies that there are also a variety of situations to be considered.

The teacher is addressed as a principal actor to focus on, in all implementation processes. Three dimensions of the teacher's life and role are considered: teacher training and education, teacher in-service professional development and teacher's practices. All of them have profound implications when it comes to devising implementation strategies.

Puglia refers to teacher education and training, pointing out that the teacher who educates future teachers lacks the level of digital literacy required. "The teacher of teachers is a model", says Puglia. "If teachers and educators do not include technology, then the models trainees ... see are not the most adequate to the competencies we want them to develop" As for teachers' in service, Puglia refers to a more personal dimension: teachers' feelings and attitudes associated with the use of technology. Frustration in the use of technology may lead to discouragement and resistance. At the same time, there are new students' needs to develop competencies that were not required thirty years ago. Puglia seems to picture a reality which is much more challenging than having and using technology at hand. It refers to building a new mindset to approach a reality with profound generational and cultural changes for some of the most experienced professors.

Brovetto also addresses the lack of digital literacies as one of the big challenges to be faced: "We face the lack of teacher´s literacy on digital pedagogies" She points out another barrier: a tendency to work in isolation from other colleagues. She says "That is a barrier. Because in any innovation and especially if it requires technology ... you either work together with others, or it is very hard".

Now, when it comes to strategies to approach the complexity of teacher development, respondents refer both to unfulfilled needs for which institutions have no answer and to specific strategies being carried out. Rodés states that leaving competency development purely reduced to spontaneity is ineffective. "There have to be specific programs", she says. "It does not take place spontaneously. Specific objectives are needed". The main choices addressed by the three referents are collaborative work

among teachers, reflective practice and allowing for synergic processes to take place among teachers and among institutions.

Collaborative work is conceived in many ways. Puglia refers to generating room for teachers with a technological background to work side by side with pedagogy teachers, so as to create synergic reactions that would generate new knowledge, therefore new practices. Brovetto explains the strategy used by Ceibal in English, switching roles between students and teachers: "The basic dichotomy between teacher and the student ... is no longer valid. But when your students are teachers, they also have a lot of knowledge from their initial education and from their practice". She also narrates the strategy developed by Plan Ceibal in the two programs she directs. There is an agenda of topics: digital citizenship, data protection and responsible navigation. She highlights the importance of shared reflective practice. "We are much more interested in reflections, discussions and readings that are related to our practices and situations and can enrich those that we do in our practices".

In terms of how teachers' practices, they are supported by the institutions, all three respondents refer to educational resource development as a fundamental pillar of teacher practice. All three of them agree on the fact that it is generally overlooked and undervalued. It is not considered relevant when it comes to pondering promotion merits, and there are no systematic policies supporting educational resource development. Brovetto expresses: "Teachers create very rich and interesting resources, but they have no place to show or share them". Puglia points out the lack of institutional strategies while saying "we need to start generating certain actions and policies for recognition, like when we recognize a publication, we need to recognize the development of open educational resources". Rodés coincides with these needs, as she refers to some of her recent research results: "There is another level of institutions and that is recognition policies, making resource development visible as part of teacher's practice. This is usually naturalized. But teachers have no specific education, training or technical support for this". She specifically refers to the need to develop collaborative environments, built on trust and cooperation, where teachers feel safe and contained to share and create collaboratively. In her role as coordinator, Rodés has led a variety of initiatives in UDELAR focusing on formative actions with teachers of both middle and higher education.

Resource development is tied to the creation of repositories. This is a topic that springs up in the three interviews: the need for repositories, and the lack of instances to share experiences of educational resources development. Research about repositories currently available reveal the following: Plan Ceibal repository would be more accurately defined as a navigation and not as a repository. UDELAR has recently launched

the "Repositorio Institucional de Recursos Abiertos", RIdAA (Institutional Open Access Repository).[2] It was an initiative of the Library Network of the Education Training Council and it was implemented by the Repository Creation Commission. The repository has three categories : academic and scientific production, educational resources (production related to teaching) and transparency (resolutions, regulations and agreements). RIdAA adheres to the Open Access Initiative that upholds the principle of free availability of information and academic production through the public Internet (Budapest Open Access Initiative, 2002). RIdAA also adheres to the National System of Digital Repositories program, which will gather the production of the national repositories and will provide data to regional and global aggregators.

In terms of systematic teacher development education programs, such as postgraduate studies, Puglia refers to cooperation programs with public and private institutions, fostering these synergies referred to above. Some of the participating institutions are national universities (public, privates) and also foreign universities and also FLACSO (Latin American Faculty of Social Sciences), an international organism. They all participate in different post graduate education programs and courses addressed to teachers. Telefónica, -the international telecommunications company - has open source virtual classrooms. It supports the development of teaching with technology in Uruguay, as part of its corporate social responsibility program. However, the Uruguayan education system has no part in it. Likewise, Rodés refers to the existence of a centralized program, led by CSE, which aims at teacher development displaying a variety of formative actions, although not as far reaching and systematic as the needs would require. Also, there have been inter-institutional initiatives, for example the one between UDELAR and the Federal University of Rio Grande do Sul, in Brazil, which resulted in an inter-institutional PhD program in educational technologies.

Another variable addressed in reference to implementation is territory and the challenge of reaching the whole country. Both Plan Ceibal and CFE are organizations that intend to reach every one of the nineteen departments of the country. Ceibal has lately reached rural schools and works with teacher mentors who get involved in the local realities and work side by side with resident teachers. CFE copes with a great difference in institutional backgrounds, organizations and human resources that are deployed throughout the 32 teacher training centers. UDELAR, on the other side, is undergoing a decentralization process that has not

[2] Consejo de Formación en Educación. https://www.google.com/url?q=http://www.cfe.edu.uy/index.php/informacion-institucional/organigrama/78-novedades-institucionales/3671-cfe-presento-su-repositorio-institucional-de-acceso-abierto&sa=D&ust=1585700042465000&usg=AFQjCNGoRmTyA-iXDz_LKJI3Vh7dDmcYFQ

reached the whole country yet. These topics will be further developed in the following section about policies.

ICT policies: the challenge of institutional policies

Implementation processes reflect institutional choices and policy design. The three referents interviewed explain the details of implementations and also comment on the principles and values that inspired those institutional choices that later become "the policies" to be implemented. They also state their personal perspectives on those policies in a more or less critical fashion. Some core concepts that seem to structure and organize these perspectives are innovation, inclusion, making informed institutional choices and the policy design in reference to other stakeholders.

The topic of innovation, unfolds interesting developments in all three interviews. In the case of Brovetto, it is related to teachers' attitude in a continuum between openness and risk-taking on the one hand and resistance and isolation on the other. To Brovetto, innovation is tied to a pragmatic level where practice meets theory. It develops by "...working on this gap, providing support and elements to bridge this gap between theory and practice". In this context, having an action plan that involves collaboration and mentorship becomes a key element.

Brovetto expresses that Ceibal in itself comprises innovative processes. She supports that idea by exemplifying with Ceibal in English.

"Instead of having a teacher that comes to class every week to teach English we have a remote teacher. It is a teacher who teaches through technology. However that's only part of it. The most interesting innovation is from a pedagogical perspective".

She reflects on innovation as a change that takes place in the field. It consists of practices that undergo change and emerge from actual interventions that involve collaboration. She goes on to develop the pedagogical change reflected in the new practice: "One is a remote teacher who is the expert in English. But the other one is the one who knows the students, the way they work, the way they learn. ... for many teachers it was very innovative to work with a remote teacher who is perhaps Uruguayan or perhaps not".

Brovetto also identifies innovation in a shift of perspective in the curriculum.

> "Our education system focuses primarily on content, disciplinary content, and curriculum content, and although teachers are familiar with creative

> and critical thinking, their focus is typically not on teaching critical thinking or creativity. And that is what Global Network invites teachers to do. We are going to focus on creativity, critical thinking and citizenship".

Puglia, on the other hand, takes the word innovation with a bit of suspicion. "...innovation is sometimes taken as a desired objective and if you are not innovative, your practice is wrong. I don't think so. There are many inclusion processes that are good and they are not innovative per se". He goes on to assert that Innovations have to be sustainable in time. He provides an example he considers innovative in the use of videoconferencing in hybrid teaching courses.

> "...students ... started having video conferences in synchronic face to face encounters that would have been impossible otherwise. The improvement was in the access, quality time with the teacher ... it is a practice that has been incorporated... There you have an innovation that has been incorporated".

Rodés also starts questioning the notion of innovation in itself, depending on what is meant by it. When asked "how innovations are used", she reacts: "Well ... that is a wrong start. Because it seems that innovation comes from abroad and innovation is technology". She later expresses that in education, the innovation is in the educational process itself, not in the technology used. She makes a clear cut with the notion of adoption. "We adopt the technology, but the innovation is not in the adoption. It takes place in what people do with the technology, in pedagogical terms".

Turning to the topic of inclusion, Brovetto explains that inclusion has always been in the agenda of Plan Ceibal. "Ceibal's identity is inclusion and equity", she says. She clarifies that initially, Ceibal was not an educational program, but rather a digital inclusion program. When asked about specific excluded groups such as people who are territorially excluded or people who suffer certain cognitive, visual or psychomotor disabilities, she responds that all of them are somehow considered. "Resources were thought wide enough to include all students. The main theme is how teachers use them. Remember that we do not work with students directly". Later she develops the idea that the answers to inclusion are related to using accessible, adaptive platforms. This means that inclusion is supported by developing more and more adaptive material and software designed with the idea of Universal Design.

When referring to inclusion, Puglia highlights how territorial exclusion has been tackled by developing hybrid teacher training and education programs for future secondary education teachers. Those who live in the interior of the country, where there are not enough human resources to

create a full scale face to face program, can take all the common subjects with future primary school teachers, and the specific ones referred to their discipline, completely online. This is both territorial and social inclusion of economically vulnerable groups. Puglia informs that the hybrid program has had an exponential growth in the registration for 2020.

Rodés offers a different perspective, referring to the development of inclusive educational resources. She refers to one particular experience called BIDYA, developed by the Interdisciplinary group of Accessible and Open Educational Resources of UDELAR. BIDYA, which is an acronym for BIblioteca Digital Y Accesible (digital and accessible library) allowed a series of resources to be adapted to the blind. Rodés explains that it did not involve just making resources available, but it requires competency development by these excluded groups. Again comes adoption in her words: "It has to come along with a strong adoption strategy, actions in education, actions in communication, actions in implementation and actions in promotion, that go hand in hand with the adoption process". She explains that this process requires working together with the specific target communities (the association of blind people in Uruguay), their families and closer people, who usually conform pretty tightly to interwoven communities with few external connections.

In reference to institutional choices and policy design, issues addressed bring along perspectives on values that inspire those choices and also on stakeholders involvement.

Brovetto, expresses that Plan Ceibal works with a variety of institutions in the private, public and business sectors. She stresses the leading role of importance of State actors in the receptiveness to initiatives to conform Ceibal's agenda. She does not make any further reference to implications of the policies designed or how Ceibal should relate to these different sectors. Her discourse focused mainly on practical issues and educational principles related to implementation.

Puglia refers to the need to have unified policies, supporting each other towards a common objective. He expresses that at a national level, many different institutions should work in synergy. For example, in reference to creating a policy towards educational resources he points out that Ceibal has its policy, UDELAR has its policy and CFE institutions have their own. He talks about the importance of an inter-institutional open education group called "Working Group on Open Education in Public Education", within the framework of the Coordinating Commission of the National System of Public Education of the Ministry of Education and Culture of Uruguay. This group drafted the document "Guidelines

for an Open Education Policy in Public Education in Uruguay" [3] which is part of a broader agenda to be promoted by the Working Group on Open Education in Public Education. The working group is composed by Rosita Angelo Director of Education, María Noel Hernández and José Mignone (MEC), Miguel Álvarez (ANEP-CODICEN), Virginia Rodés (UDELAR) and Juan Marrero and Juan Mottola (UTEC). He highlights the fact that it is interdisciplinary and interinstitutional. *That*, unified perspective, he believes, would be an adequate strategy. It means pondering political issues when it comes to regulations, in order to provide adequate advice to institutional decision makers that influence at a national level.

Rodés, whose position is more tightly related to policy development, both in management roles and in research activity, holds a stronger and more detailed opinion about the implications of policies to the place and the way stakeholders and business sectors get to be involved. She believes that institutions have not developed awareness of the relevance of expert advice when it comes to making policy decisions. She expresses that decision makers should be advised in political issues related to technology. She refers to issues of privacy, personal data, safety and copyright. She questions decisions that are made under an assumption of a supposed technological neutrality. In her words: "...there we have a huge problem, because people are being object to commercialization". Rodés develops the idea:

> "Platform capitalism has permeated issues of access, not only in the technology itself, but also in sources of information. That means putting personal data at stake, added to access barriers due to copyright issues... For educational institutions, it has become harder and harder to evade the magical commercial solutions... It is harder to compete from a position of adequate and sovereign development".

Rodés makes a point on an issue that she places beyond education. "We are on an edge between what is positive and what is extremely harmful, not just for education, but for the individual and for society". This notion comes to expand and enrich the idea of digital literacy, into the universe of digital citizenship. This reflection places not only students and teachers in a need to acquire it, but also researchers and decision makers.

Using the visualization facility of the codification tool Qode, we produce radar graphics on the topics addressed by interviewees. From graphic on Image 1, it is observed that Puglia focuses more on institutional management, institutional policies, strategies and the relevance of infra-

[3] http://www.nucleorea.ei.udelar.edu.uy/lineamientos-para-una-politica-de-educacion-abierta-en-la-educacion-publica-de-uruguay/

structure, connected to the variety of centers and territorial contexts. Image 2 shows that Rodés focuses on policies and institutional choices. The other main semantic area that structures Rodés's discourse is the notion of innovation and how it connects to policy choices and resource development strategies. On the other hand, Image 3 shows that Brovetto´s interview revolves more around how digital literacy development and inclusion issues are tied to institutional implementation strategies, availability of technological resources and changes in the curriculum.

Image 1. Enzo Puglia content analysis graphic representation

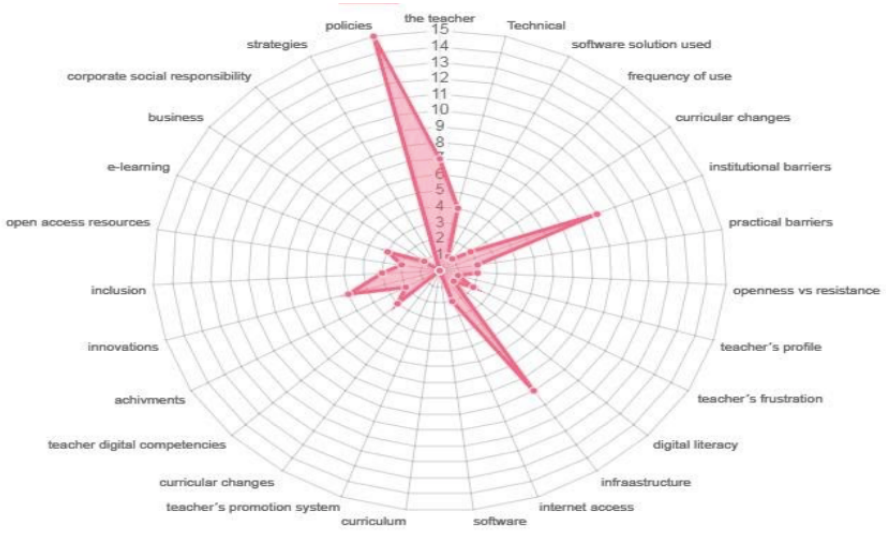
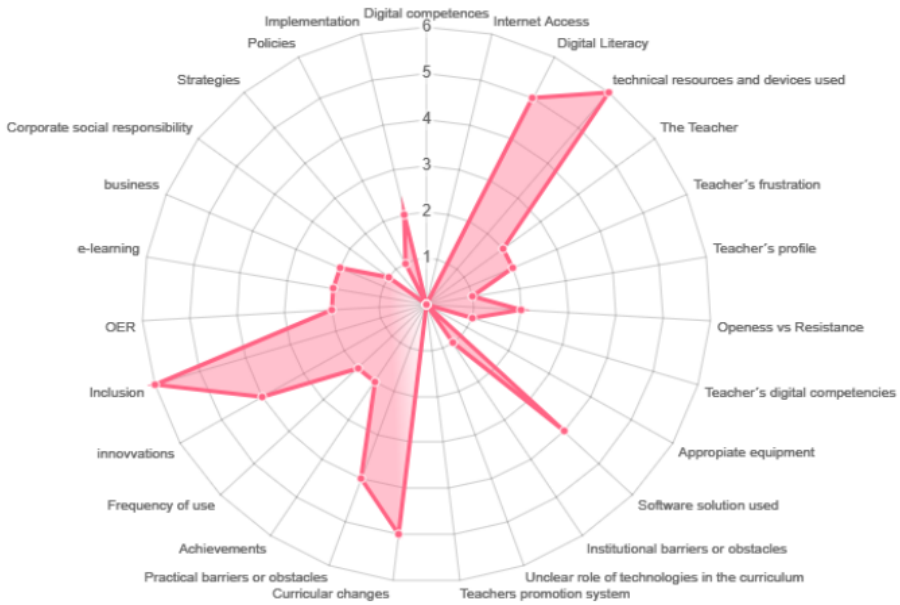


Image 2. Virginia Rodés content analysis graphic representation

Image 3. Claudia Brovetto content analysis graphic representation



Discussion

Three very prominent institutions in Uruguayan educational context are represented by these three referents: UDELAR is the biggest and oldest public university in the country, CFE is the organization that nucleates all public teacher training and it is present in all the country. Plan Ceibal is undoubtedly a referent in and outside Uruguay for its national reach and ambitious objectives. Together, these three referents provide a perspective of the development of ICT integration in Uruguayan formal education.

Availability of technology is clearly not a problem in our country and a great achievement in terms of overcoming digital exclusion is acknowledged, although all respondents agree that there is still room for further improvement, particularly in terms of availability of individual devices beyond the cellular phone. This is consistent with a national context of public policies displayed in Uruguay throughout the last fifteen years. Some of the policies that fostered digital inclusion were Plan Universal Hogares, Plan Ceibal and Plan Ibirapitá. All of them have been effective in reference to digital inclusion (ITU, 2018).

Implementation has been carried out in a variety of ways, following different plans and programs. All of them have been touched by the characteristics and challenges of its particular institutional context and territory. In those contexts, institutional governance, territorial variables and the ability to generate inter-institutional synergy, are paramount.

Diving into the subject related principal terms used and how they picture the situation ICT in education in Uruguay, some specific references need to be made. Notions that are abundantly used throughout the interviews are digital divide and digital literacy. Digital divide refers to a distinction between those who have access to the Internet, being able to access quality services through the World Wide Web, and those who do not. It would be initially related to having connectivity and devices such as laptops, tablets or cellphones. More recent revisions of the concept would argue that the term does not account for the variety of situations that could be considered, in what seems to be a continuum of situations between "having and not having" access to the benefits of the World Wide Web so as to see your life positively affected by it (Helsper, E. J., & Reisdorf, B. C. 2017; Van Dijk, J. A., 2017).

The term digital literacy was first introduced by Paul Gilster as "the ability to understand and use information in multiple formats from a wide variety of sources when it is presented via computers" (1997, p. 6). This concept has also evolved in its meaning.

> "Definitions of the term now range from simply being technology fluent to the ability to apply information literacy skills (e.g., locating, extracting, organizing, managing, presenting and evaluating information) in digital environments to broader, more complex conceptual frameworks that encompass a wide variety of skills, understandings, norms and practices" (Meyers, E. M., Erickson, I., & Small, R. V.,2013, p 356).

The fact that these are slippery concepts that keep evolving, makes the implementations of digital divide bridging and digital literacy development strategies, even more demanding. Moreover, digital literacy is not enough, it is applying it to the teaching profession that really makes the difference. However difficult this appears to be, respondents seem to agree on some opinions: Empirical evidence as well as personal experience shows that effectiveness is tied to teacher involvement, particularly in programs that imply collaborative work, sharing and building community. The teacher becomes the center of all implementations that aim at technology appropriation processes. Teacher's profile, teacher's background, teacher's attitude and teacher's involvement, seem to be determinants of success.

Exploring some dimensions of teacher's acquisition of digital technologies, interviewees talk about practice teaching and about educational resource development. Each one requires its specific strategy. But there is a strong emphasis on the relevance of creating the conditions for community building and collaborative work. There seems to be a need to reconsider institutional frameworks and policies, because the teaching profession seems to have outgrown its original model in order to work in a digitalized world and a new social reality. Institutional and organizational structures and strategies seem to need more than a few changes, as far as respondents discourse goes. Some mechanisms that are claimed for are, for example virtual legitimate spaces to develop and share educational resources; also, institutionalized mechanisms to make those new collaborative practices matter and count when it comes to merits and recognition.

Innovation appears like a central issue, with different perspectives, both in terms of its theoretical background and also in terms of word usage implications. Educational innovation has been defined in the literature of the profession as a process that responds to needs and intends to produce an improvement in the learning outcomes, being sustainable and transferable beyond the immediate environment (García-Peñalvo, F. J., 2015). Aguerrondo, (2002) observes that innovating implies changing the paradigm, understood as a change in ways of doing, ways of thinking, valuing and perceiving. (Viñao Frago, 2002) adds the notion of school cultures, a dimension that helps in the understanding of how profoundly rooted in culture educational practices are. He refers to a school culture

built throughout time, as a set of ideas, norms of behavior, rituals, habits and practices, and all that a culture entails. This is the underlying foundation for the way the school is perceived and considered and reproduced by teachers, students and all people involved within the institutional boundaries and even beyond. This culture is the one that changes, even if partially, when a real innovation takes place. This is the notion of innovation that respondents seem to adhere to. That is why there are so many references to innovative processes that take place in the community.

An example of this innovation as a social process is the following: Brovetto talks about Ceibal in English and all the unprecedented practices such as a remote teacher who is actually a native speaker of English, cooperating with a local teacher who knows the group but does not know English. This practice, for example, comes to change many rules in the game of teaching. These are "...new frameworks of co-teaching and collaboration between in-person instructors and remote instructors connecting from anywhere in the world " (Kaiser, 2018, p.76). This changes not only the usual roles -the teacher as the one and only "know-it-all" but also changes the relationship with students, when they see that their regular teacher is also learning. Rodés refers to the same process when she insists on the fact that "We adopt the technology, but the innovation is not in the adoption. It takes place in what people do with the technology, in pedagogical terms".

This idea of innovation residing in what people do and not in technology itself, questions the notion that innovation can be located within the technology, in a reification process. That is to say, using a certain tool, gadget or software in education, does not necessarily mean getting involved in an educational innovative process. If this were the notion, then technology would be considered from an instrumentalist or from a deterministic view. However, empirical data as well as research shows that teachers' assumptions matter and condition the way they perceive, react and act towards technology (Adell, 2018).

As for policy development, two of the respondents (Puglia and Rodés) are particularly keen at observing the political implications beyond the immediate needs for technological solutions. They both point out different impacts of institutional decisions and how the rest of the educational system and the society are affected.

As a reflection, the challenge is evident and given the current circumstances under which this paper is being written, it is also overwhelming. The following words from Tony Bates picture questions that seem to be relevant to educators of all levels, not only teachers who work with future graduates.

> "...teachers and instructors are faced with a massive challenge of change. How can we ensure that we are developing the kinds of graduates from our courses and programs that are fit for an increasingly volatile, uncertain, complex and ambiguous future? What should we continue to protect in our teaching methods (and institutions), and what needs to change?" (Bates, 2018, p.15)

Further studies

Going back to the title and considering the results of this exploratory study, it can be concluded that the following three topics are the main challenges of ICT in education, identified in this study. These topics should be the object of further studies.

Teacher development in reference to technology integration to teaching practices, seems to be an extremely relevant issue, both at pre-service and in-service levels. The "when" and "how" of technology integration in pre-service educational programs and its implications for curriculum design seem to be at the heart of the matter. The question comes again for in-service teachers, although more answers seem to have been found by ongoing programs, particularly those initiatives that implement collaborative learning opportunities.

Secondly, there is the issue of teachers and educational resources. Selection, creation, authorship and licensing, are all tied to how resource development practices are considered, recognized and integrated to the teachers career, merit and promotion systems. This topic seems to connect practices to institutional regulations in such a way that it seems impossible to work on one without affecting the other.

Institutional policy definitions, experts' advice and political implications also constitute a core matter when it comes to ICT integration to education. What lies beneath, is the fact that technology is not neutral. Which educational technology is selected? Who develops the educational technology that is used in the country? Under what conditions is it acquired and appropriated? Answering these questions requires making decisions that should ponder matters of national sovereignty versus dependence, just to name one of the challenges faced. This topic does not seem to have reached the status of public issue in the current Uruguayan educational agenda.

Finally, going back to the special circumstances due to Covid 19 and how educational processes have been affected, it is fair to say that all of the referents' answers, refer to a state of the art that is previous to this ongoing contingency of being forced by the circumstances, to teach

online. How will appropriation processes evolve? Will these events and conditions affect the way teachers perceive technology applied to teaching and to learning? Institutions in Uruguay, as well as in many parts of the world, have had to devise quick solutions, resorting to both known and new tools and strategies. There should come a time for evaluation of impact, results and changes caused by these interventions and reactions "on the spot". There is no doubt that this is a necessary topic for future studies.

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