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ICT FOR LEARNING AND INCLUSION IN LATIN AMERICA AND EUROPE

Case Study From Countries: Bolivia, Brazil, Cuba, Dominican Republic, Ecuador, Finland, Poland, Turkey, Uruguay

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INTRODUCTION

We are presenting a unique research report dedicated to the use of digital media in education and digital inclusion. It is unique because of the countries which contributed to this monograph showing the common challenges and differences present in the selected regions of Latin America and Europe. The monograph is the result of a systemic document analysis in: Bolivia, Brazil, Cuba, the Dominican Republic, Ecuador, Finland, Poland, Turkey and Uruguay. It is the effect of participation of representatives of selected universities in the project "Smart Ecosystem for Learning and Inclusion" - ERANet17/ICT-0076 SELI, the aim of which is to: identify the challenges in the use of ICT as a tool for learning and inclusion; initiate broad stakeholder dialogue and consultation to screen potential educational, technical and business solutions for the challenges; implement knowledge transfer of tested and effective solutions rooted within the media pedagogy paradigm of opportunities and create an education platform with tools to support work with disadvantaged individuals and groups such as migrants, the elderly, the physically challenged, and the deaf and dumb.

This book is a milestone for the analyses of the existing documentation, conducted by the representatives of nine academic centres. The results presented herein refer to the results of investigations into the key areas of digitally supported education and activities facilitating social inclusion and its subcategory – digital inclusion. Every chapter presents the general contexts of using the ICTs in education in the perspective of the development of the society saturated with the Internet and digital devices – the new media. Authors of the individual texts try to emphasise the meaning of digital literacy and data reflecting the level of digital gap, as well as the challenges faced by the selected European, Latin American and Caribbean (the Dominican Republic) countries. They also refer to the local, regional and governmental social policies, presenting the contexts – and good practices – in which preparation of teachers to use ICT, the process of reducing the digital divide and improving digital literacy take place. An important element of the work was to outline the issues relating to the educational innovation like: blockchain, digital storytelling, flipped learning, personalised learning or sharing pedagogy. The publication is an overview, however, the texts are the attempts to diagnose and determine the

role of the certain actors responsible for the process of successful digital inclusion and implementation of innovative ICT-based solutions into the formal and informal education. The selected chapters also form a catalogue of good practices implemented in the certain countries. Such point of view may prove particularly useful for further research in the field of comparative pedagogy, media in education, adult education or social policies.

We hope that this theoretical compilation will provide a valuable perspective for exchanging learning experiences through the transfer of the best solutions and presentation of the challenges faced by the countries participating in the SELI project.

On behalf of the SELI team
Łukasz Tomczyk

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ICT IN EDUCATION: THE SITUATION OF BOLIVIA

Abstract: Nowadays, Information and Communications Technology (ICT) in education is an essential aspect of technology and society. The last ten years Bolivia improved developing indicators such as literacy, poverty reduction, technology penetration; but it was not enough to reach other Latin American countries development level in ICT. The government efforts to spread technology access in the broad territory and improve ICT usage has an impact on the Bolivian society, and these efforts also reach the education sector. However, income and accessibility to technology shows inequalities between low income against higher-income people, and also relate to the urban/rural area where people live. There is not enough information about how ICT has penetrated and used in disabled education nor how to deal with ICT in pre-service teacher instruction. The Smart Ecosystem Learning for Inclusion Project from ERANet LAC addresses Education and Inclusion with ICT. It can help to improve the ICT usage indicators from Bolivia, who will reach until 2025 full internet access.

Keywords: Bolivia, ICT, school, digital inclusion

Last ten years, Bolivia has experienced changes in the way how the population interact and behave due to the information society. The government initiated ambitious plans to reduce the digital divide in the country and to introduce ICT in education. Despite the efforts, the country has slow development progress of ICTs related to Latin American countries and the world.

This document first presents an overview of the demographic characteristics, education system, and ICT state in Bolivian education. Presenting ICT and education is focused on the efforts of the government to provide to the schools with hardware equipment and full access to the Internet; the government efforts also address the pre-service teachers and teachers qualification in ICT. The next two sections discuss the ICT situation in relating to disabled education for people with cognitive and physical difficulties. The fourth and fifth sections refer to the ICT state as regards use and challenges in terms of education. Finally, the last part presents some recommendations and conclusions for the Smart Ecosystem for Learning and Inclusion project (SELI) concerning Bolivia, and the recommendation has the purpose of providing to the project team with information about Bolivian needs in terms of pedagogical and technology needs related to ICT in Education.

Brief Bolivia insight

According to INE (2018a), located in the centre of South America, Bolivia has an extension of 1 098 581 square kilometres. The Andean zone is over 3 000 masl, covers 28% of the Bolivian extension and between two mountain ranges; the sub-Andean zone or valley covers 13% of national extension; the valley cover 59% of the extension as mentioned by the National Institute of Statistics (INE) of the Plurinational State of Bolivia.

The population density of Bolivia is 9.3 inhabitants per square kilometre. The core region that corresponds to the cities of La Paz, El Alto, Santa Cruz de la Sierra, and Cochabamba has the highest density. The population in urban areas reaches 67.5%, and in rural areas, it reaches 32.5% (INE, 2015).

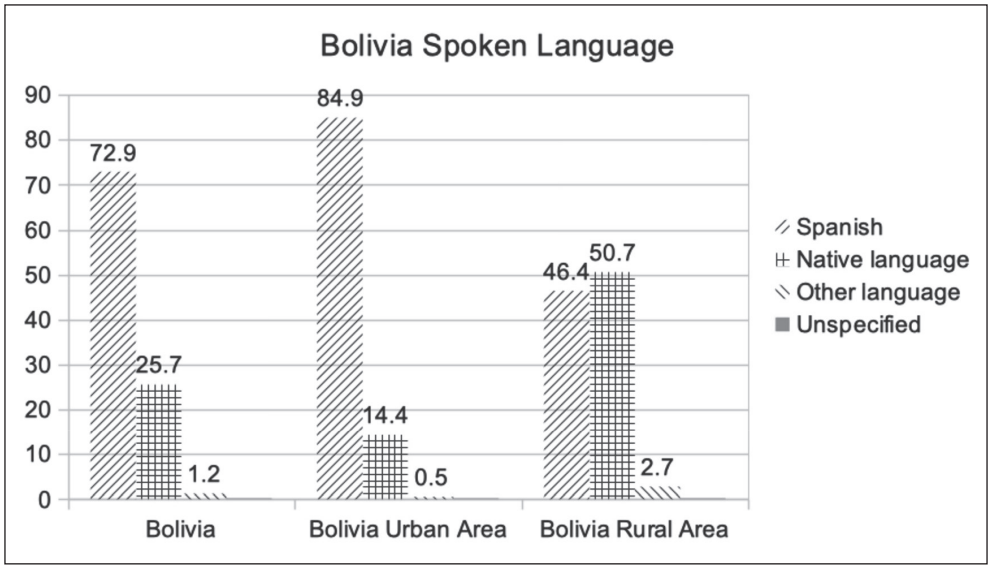

Figure 1. Spoken Language by area

Bolivia's population is approximately 10 896 000 inhabitants according to the Household Survey 2015 (INE, 2018b). The urban population is 68.5%. The spoken languages in Bolivia are Spanish with 72.9% of speakers and native languages (Aymara, Quechua, Guaraní, among others) with 25.7%. There is a marked difference in the language spoken between the rural area and the urban area, in the former, 84.9% speak Spanish in contrast with the later only 46.4% of people speak it. See *Figure 1*

The twelve years are compulsory Bolivian education system spend six years for primary and another six for secondary school. The average study years of the population are 9.25. The average years of study reached by women are 8.6, and for men, it is 9.9. In the female population, there is a significant dropout in the average years of study; cultural factors explain this higher dropout. One of these factors is the custom of assuming

women at an early age, a large number of household chores, and the assumption for women is not necessary to finish school.

Approximately 7.5 million people are over 14 years old, with a 92.5% percentage of literacy (INE, 2018b). Only 88.6% of women compared to 96.5% of men who can read and write. The level of literacy in the rural area is 83.6%, lower than urban areas. As in the country's total, rural women's literacy is 75% against 92.2% men. In urban area literacy level is 96.2%, the men's literacy is 98.5% against women's literacy 94.2% (INE, 2018b). See *Figure 2*.

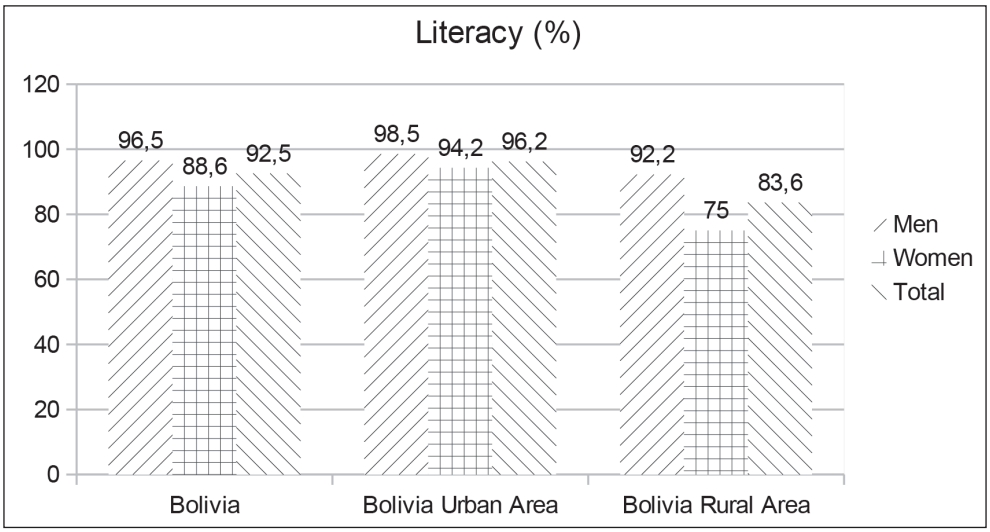

Figure 2. Bolivia Literacy by area

Looking for regular education, 8.2% of the population indicates they do not have a minimum regular education level (they never attended school, or left it), 27.6% indicates they reached the primary level, and 38.2% reached the secondary school one. Finally, 25.9% indicates they attained a higher education (university) (INE, 2018b).

ICT in Education

Bolivia has presented in the last ten years an improvement in literacy indicators, poverty reduction and the digital divide. The first two influence the digital divide, as in the International Telecommunication Union (ITU), which in the ICT Development Index calculation considers variables related to schooling and the level of ICT use in the sub-index skills (ITU, 2019a).

A description of two main reasoning or approaches regarding the use of technology: social, and pedagogical is in (Voogt, 2008). Social reasoning implies learning to use technology, related to necessary skills in ICT use incorporated as a subject in school.

Pedagogical reasoning refers to observable elements related to thinking about teaching and learning. The pedagogical reasoning manages to include ICT as a tool for learning and teaching. It has more considerable difficulties due to access, degree of skills in the use of ICT and teachers comfortability with technology. It is essential, in countries under development such as Bolivia, to incorporate the use of technology into education as extra effort; that is to say: not only learn to use technology in everyday life but also convert it into a useful tool for learning and teaching.

The ITU fulfils responsibilities as a specialised agency of the United Nations and implementing agency to execute projects under the United Nations development system or other financing agreements, to facilitate and improve the development of ICT. This organisation measures the ICT Development Index (IDI). To measure this index for Bolivia is necessary to have the following data related to education: the average number of school years, the percentage of people enrolled in secondary school, and the percentage of people enrolled in higher education (tertiary).

In addition to the subscripts related to education collected from the Ministry of Education and data collections of the United Nations Educational, Scientific and Cultural Organisation Institute of Statistics (UNESCO), the IDI calculation involves people ICTs skills. These skills are essential like the use of files, folders, email, office suite tools, software installation, file transfer, and use of programming language (ITU, 2018), (ITU, 2019a) and (ITU, 2019b).

The IDI uses the following index (measured on a scale of 0 to 1): access infrastructure, use, and skills in terms of training. These three indexes are divided into subscripts, as described in (ITU, 2018).

According to (ITU, 2017), Bolivia has made progress in reducing the digital divide. However, Bolivia is a country with the slow development progress of ICTs related to Latin American countries and the world. Bolivia presents sustained growth, but this is not enough to reach the development level of other countries. In the case of Bolivia, the IDI 2017 is 4.31 compared to the world average of 5.11. The global access sub-index[1] is 5.59 in contrast of 4.42 to Bolivia, the global use sub-index[2] is 4.26, and it is 3.38 for Bolivia, the global skills sub-index[3] is 5.85 and for Bolivia 5.96. At the continental level, the IDI average is 5.21, the sub-index of access, use and skills are 5.64, 4.21 and 6.34 respectively.

The main IDI improvement in Bolivia is in subscriptions to broadband mobile telephony; by contrast, the increase in internet users and Internet access from home is

[1] The global access sub-index captures: ICT readiness, infrastructure and access indicators (fixed-telephone subscriptions, mobile-cellular telephone subscriptions, international Internet bandwidth per Internet user, households with a computer, and households with Internet access)

[2] The global use sub-index captures ICT intensity and includes three intensity and usage indicators (individuals using the Internet, fixed broadband subscriptions, and mobile-broadband subscriptions)

[3] The global skills sub-index capture capabilities or skills measured with adult literacy, gross secondary enrolment, and gross tertiary enrolment

low: the increment is from 0.03 to 0.04 between the period 2016-2017. Access by Fixed broadband internet does not have a significant change compared to 2016: from 0.69 in the year 216 to 0.72 in 2017. Bolivia is among the developing countries, according to the IDI computed for 2017; likewise in the report (ITU, 2017), it notes Bolivia is a very dynamic country in the change of IDI from 2016 to 2017 advancing five positions upwards. Bolivia is experiencing a change in intensity of use, which, compared to Nicaragua, is insignificant since Bolivia increases by 0.98, while Nicaragua does so by 12 points. Bolivia and Nicaragua are two of the most dynamic countries in Latin America and coincide with their success in expanding access to mobile telephony and the Internet through it.

The data from INE (2018b), one of the latest publications on ICT data, shows the following results in terms of Internet access:

- In urban areas, 33.1% of households have access to a computer, against only 6.4% of households in rural areas
- 20% of households in urban areas access the internet, against only 4.2% of households in rural areas.
- 69.9% of people use a mobile phone, most of them, not have a smart device.
- 37.5% of people use the Internet, but not necessarily use it from home, and 36.8% use a computer but not necessarily have one. The use of the computer and Internet access that these people make can be from an Internet Café.

According to the INE, based on data from the 2012 National Census, a projection of population estimated 11 307 314 inhabitants in 2018, by 2016 the projection is 6.8 million Internet connections, and for 2017 there would be 9.3 million internet connections that include access from mobile phones (INE, 2018a). According to a report by the Telecommunications and Transportation Regulation Authority of Bolivia (ATT), in 2016 there were 6.8 million Internet connections, and by 2018 it reached 11.4 million mobile telephony lines enabled with 9.9 million Internet connections (Autoridad de Regulación y Fiscalización de Telecomunicaciones y Transportes, 2019b). These two sources of information, the first as a projection based on data from the 2012 national census and the second with statistical data from the ATT to December 2018 show a significant increase in access to mobile phones and Internet access: access to the Internet increased by 30% between 2016 and 2018. Notice that the number of mobile phone lines does not imply access to the same number of people to this technology and much less access to the internet.

In Bolivia, 4.97% of the connections use a speed higher than 1024 Kbps, 82.6% use a connection between 512 Kbps and 1024 Kbps, 10.1% between 256 and 512 Kbps, and the remaining, 2.4% use speeds slower than 256 Kbps was, according to (Autoridad de Regulación y Fiscalización de Telecomunicaciones y Transportes, 2019a). The average speed for Bolivia is 2.69 Mbps according to data from (Chevalier, 2019), and in Latin America, the average is approximately 6 Mbps according to (Economic Commission for Latin America and the Caribbean- United Nations, 2018).

According to INE (2017) in Bolivia, there are 179 689 teachers, 79% of them work in urban area schools. Only 52.7% of these teachers graduated from the Superior Normal School, 37.7% have a bachelor's degree, and 6.2% have a master's degree. From the total of teachers, 58.2% are women.

The Agency of Electronic Government and Information and Communication Technologies of Bolivia (AGETIC) in (Agencia de Gobierno Electrónico y Tecnologías de Información y Comunicacion, 2018c) according to data from the Ministry of Education, indicates the distribution 129 875 computers to teachers with the „One computer per teacher" project. This quantity of computers corresponds to 72.3% of the teaching population supplied with a laptop. This project began in 2011, and the benefit corresponds only to teachers of public schools. The state fully maintains the public school and some public ones under government agreement whose infrastructure is maintained mostly by non-governmental organisations (many of them are religious organisations). However, the state provides the teacher's salary. The project „One computer per teacher" has not reached private schools.

In the project „one computer per student", from 2014 to 2018, 4.39% of students have been equipped with a computer (Agencia de Gobierno Electrónico y Tecnologías de Información y Comunicacion, 2018c). By regulations established by the government, students cannot remove computers from the school, since an anti-theft mechanism protects them and the principal of the establishment has the responsibility of this equipment. The above percentage includes private school students; however, that house 15% of the students. The data on the distribution of computers in public schools show discrepancies. The discrepancies are in the distribution concerning the student population by department and city. In the case of Tarija city, the distribution of the computers reaches 41% of its student population, while other cities such as El Alto reach 5.36% of its student population. Consider also the large cities of the Bolivian trunk axis (La Paz, Cochabamba, Santa Cruz) each one covers approximately 4% of its student population. The percentages of computer distribution are lower in far country-side villages, where the level of poverty is high, and the provision of services such as electricity and water is insufficient or non-existent (Agencia de Gobierno Electrónico y Tecnologías de Información y Comunicacion, 2018c). The computer-delivered for the benefit of the student population is called Kuaa, which is assembled by the public company Quipus. Kuaa computers are based on the Classmate PC model[4] and use Classroom Management Software in the local network; these computers come with two Operating Systems Debian 7.x (a distribution of Linux) and Windows 8 Pro, additionally have free software installed as Geogebra, Scratch, Avogadro, LibreOffice Gimp, OpenShot, among others; and contents developed by the ministry of education (alphabets, dictionaries of different languages spoken in Bolivia, texts and books of school contents in Bolivia in chemical physics and

[4] https://en.wikipedia.org/wiki/Classmate_PC

mathematics) as indicated in the press release in the newspaper La Razón („Ordenadores bolivianos Kuaa tienen software libre", 2014). It is essential to see the Kuaa computers offer the choice between licensed software and a free one. It also deserves to take into account the promotion of open source software usage to the students. It is a good practice in the Bolivian society costumed to get piracy licensed software. Usually, the software is too expensive for the low Bolivian budget.

The strategic plan by the government implies the provision of computers to teachers and students (PRONTIS, 2014). The plan includes the complete installation of the electric network, data network infrastructure. It supports local network access to material in the server by the student's computers. These installed technological bases require the provision of services in schools such as internet and electric power as well as adequate environments for their operation. These requirements have forced the government to choose the best-equipped schools to receive the technological bases installed and the Kuaa computers. These existing inequalities in school infrastructure and the municipalities to which these schools belong to maintain a digital divide influenced and related to economic inequality and poverty. According to the Ministry of Education, the installation of Technological Bases between 2014-2016 reach up to 2 554 schools.

The Technological Bases and Kuaa computer's distribution is not proportional to the distribution of students and schools in the national territory since they depend on the services presented in each municipality and school. The absence of services, as shown in the previous paragraph, explains the distribution of computers against the student population. This distribution is not proportional to the student population.

In press releases such as (Rivera, 2018), (ERBOL, 2015) and (ERBOL, 2017b) evidentiary problems with the Technological Bases and Kuaa computers at use time, due to technical issues. The Kuaa computers are under the responsibility of the educational unit principal; and for each class, each student should receive and back the computer under a school protocol. The delivery practice of computers to students in the school reduce the adequate time of use of the device. In many schools, the computer transit from the environment where they are stored in the classroom sometimes activate the anti-theft, and the equipment remains blocked until the technical service goes to the school to solve the problem. The Minister of Education in February 2017 in the press release (ERBOL, 2017a) indicates a maximum of 20% of educational units do not use the Kuaa computers. The 80% of educational units make occasional use of computers and some make continuous use, but the percentage of educational units that make this use is not specified. The same press releases, states there are problems in the educational units affecting to the computers and technological bases such as lack of adequate environments for computers, no connection of appropriate electric power, no internet connection. These problems are continuous since the beginning of the project. The Municipality is the organism in charge of the infrastructure of educational units in his territory according to national laws.

Since 2012, after the distribution of computers to teachers, the Bolivian government has conducted the training in necessary skills to use ICT: computer usage and office suite to approximately 27 149 teachers during the period 2012-2014 (Centro de Investigaciones Sociales Vicepresidencia del Estado Plurinacional de Bolivia, 2016).

AGETIC launched the Digital Inclusion programme in October 2018 (Agencia de Gobierno Electrónico y Tecnologías de Información y Comunicación, 2018b). This programme aims to strengthen the use of ICT by people with no experience or make easy use of them. The first stage of this programme focused on the secondary education level. At this stage, teachers and students of the fourth and fifth secondary school courses were trained in ICT tool use in favour of learning and teaching. The training concluded the end of November 2018 with more than 700 school students using the Kuaa computer and the software it has installed, the teachers of the respective courses were trained in the use of software and computer equipment. The first pilot training has been carried out in the city of El Alto. It will be replicated at the national level according to AGETIC news (Agencia de Gobierno Electrónico y Tecnologías de Información y Comunicación, 2018a).

The Digital Inclusion programme is an advancement of inclusion with access to technology. The projects based on „one computer per student", „one computer per teacher" and the Technological Bases installation have allowed access to technology by students and teachers; and the use of technology in the ICT pedagogical reasoning approach as part of this new programme.

In Bolivia, 32.5% of the population over fourteen years declares that they are a very infrequent Internet user (they did not use the Internet during the 30 days before the survey); it is one of the results of the ICT Survey conducted in Bolivia in 2016 by AGETIC (Agencia de Gobierno Electrónico y Tecnologías de Información y Comunicación, 2017). In this group of less frequent users, the following percentages about interest in using the Internet were obtained: 27% are not interested, 23% have little interest, 18% have an interest and 23% are very interested in using the Internet; Note that 10% did not respond about their interest in using the Internet. Thus, the people who do not use the Internet and would like to use is 73% of this population. These people can be classified according to the area where they live (rural or urban), the number of users very infrequent in the rural area is 51% (53% of these users are women). Regarding the economic approach, these users have a meagre financial income related to the rest of the population (economic profit is characterized as high, medium-high, medium typical, medium-low, extreme low). 37% of very infrequent users have an age range between 52 and 71 years; 10 % corresponds to people over 72 years old (Agencia de Gobierno Electrónico y Tecnologías de Información y Comunicación, 2018c).

Internet users in Bolivia, who, according to the ICT Survey, accessed the Internet at least once in the last 30 days before the survey, are people from urban areas. They represent 83%, these users usually live in large cities (62%), in small cities (21%), and rural

areas (17%). Women from this group represent 49% of users. In the ICT Survey reports and other documents, consulted for this report, there is no information on the relationship of women who use the internet and live in rural areas in contrast to those who live in urban areas.

The penetration of mobile telephony in Bolivia has allowed people to access the internet. The third part of the internet users in Bolivia are students, this group of users have a mobile phone, and 95% of them have mobile internet. The students mainly use it for social networks. Note that the use of the Internet is broad in „communicating" through social networks. In Bolivia, the most used networks are Facebook and Whatsapp (Agencia de Gobierno Electrónico y Tecnologías de Información y Comunicacion, 2018c).

To better understand how Bolivians use the internet in Agencia de Gobierno Electrónico y Tecnologías de Información y Comunicacion (2018c), four digital profiles are proposed: Indifferent digital (limited use mostly on communication through social networks, it is reported through communication media distinct of internet), Digital beginner (necessary use of the Internet and ignores the advantages that ICT has for carrying out their activities), Digital hyperconnected (she is continuously connected, and her life turns around technology but does not deepen it, the time and intensity of use is less than for the digital geek), Digital Geek (cannot live without internet and ICT tools, massive use for all types of activities, deepens the use of technology).

The Digital indifferent represents 20% of the users. The distribution by gender indicates a significant number of users who are women with 55%. The majority of digital indifferent people live in urban areas, 65% live in the cities. In terms of socioeconomic level, 95% are in the middle and below (low end 44%, low 36%, average 15%). Most of these users are at the low end of the socio-economic level. The access and use of ICTs represent a high cost for this kind of user.

The digital Beginner represents 46% of the users, and this is the predominant profile among Internet users in Bolivia. The percentage of women who are in this profile is 52%. The digital beginner lives in the large cities and small cities of the country, the percentage in an urban area is 83.5%. In terms of socioeconomic level, 85% are in the middle and below. Most of them do not have a fixed connection to the internet. The bulk of these users is in the low to medium socioeconomic level.

Hyperconnected users correspond to 23% of internet users. Unlike the previous profiles, the percentage of women is 41%; in this profile, male users surpass women by almost 20%. This profile of users lives in the urban area (92.5%). The activity of these users is more active in time, and the number of social networks uses. The users of this profile have a fixed connection to the internet at home. The hyperconnected has a socioeconomic level concentrated in the average (37%) and with the highest proportion of users in medium-high (25%) and high (14%). These users have more skills than the previous ones in the use of ICT; this improvement is due to the better conditions of access to the Internet and the services in contrast to the previous profiles.

The Digital Geek is the smallest profile, with 11% of the user population. The percentage of women is further reduced compared to the two previous profiles (40%). The people in this profile live in urban areas (95%). The digital Geek publishes and share information, unlike the others, use the internet in economic and labour activities. The Digital geek mainly has high, medium-high, and medium socioeconomic status.

The group of digital beginners is mainly people between 14 and 45 years old. The urban and rural area population tends to the digital beginner group by the difficulties in accessing the internet, technology and connection costs. These reasons push them to be users of social networks and use the internet, basically for communication with WhatsApp and Facebook.

Gender gaps increase when talking about frequency and skills in the use of ICT. In the indifferent and beginner profile, the percentage of women is slightly higher than men, in the hyperconnected and geeky profile, the percentage of women is significantly lower than of men.

The socioeconomic level and the area where people live affect user classification considerably. In the case of Bolivia, access to the internet in the rural area is expensive for the socioeconomic level attached to people in this area (they are in extremely low or in some few cases, low average). It should also be considered the internet access is not Retrieved from broad sectors of the rural area.

The student's percentage of internet users is 33% as observed from the AGETIC ICT Survey. The population between 14 and 25 years old is usually studying in secondary school, university or vocational training institutes. The way how the Internet is used is similar between those who study and those who work. Users access the internet to contact friends and family (73%), social networks (62%), search information (35%), music and videos (26%), academic purposes (11%), work (19%). Those who have access to a computer or laptop to use it mainly for work (55%), search the internet (44%), and study (41%). Those who have a mobile phone use it for calls (95%), internet connection (95%), taking pictures (56%), listening to music (56%), SMS text messages (55%), watching videos (41%), and games (28%).

Being the mobile phone the technology of higher penetration in the Bolivian society, its primary usage of social networking and fun by the people between 14-45 years old is not fair; only those that have a computer or tablet indicate an educative or explicit work use.

ICT for disadvantaged people and Universal Design of Instruction

According to reports Samaniego et al. (2012) and Oficina Internacional de Educación de la UNESCO (2008) on the use of ICT and education for people with disabilities, most countries have incorporated into their constitutions and Magna Carta, the importance of education, establishing that access to it is a right for all the citizens of a nation. There should not be discrimination (social, economic, cultural, gender, medical situation, age, language,

among others) when exercising their rights. The UNESCO and the UN have framed characteristics that qualify the disadvantaged population is stipulated in Bolivian regulations.

The Bolivian Constitution approved in 2009 its article 14 establishes that every human being has a personality and legal capacity under the laws and enjoys all the recognized rights without any distinction, prohibits and sanctions all forms of discrimination including those related to disability. As far as education is concerned, the Constitution states that everyone has the right to receive education at all levels in a universal and non-discriminatory manner (Estado Plurinacional de Bolivia, 2009).

By the Constitution in 2010, the Education Law 070 was enacted: Elizardo Pérez - Avelino Siñani (Estado Plurinacional de Bolivia, 2010). This law recognizes all people as subjects of rights without discrimination based on diversity proposes that the education system must be prepared to address this diversity. The Education System has a unique curriculum which includes everyone by curricular adaptations. The Education System has three subsystems: Regular, Alternative and Disabled Education, Higher Education Vocational Training. The subsystem of Alternative and Disabled Education serves two branches: Alternative Education and Disabled Education.

Alternative Education deals with young people and adults over 15 years old who, have not had access to primary education and those who have not been able to access technical or professional training.

Disabled education deals with three groups of people:

Education for people with intellectual, physical, visual, auditive impairment and people with emotional and behavioural problems.

Education for people with learning difficulties.

Education for people with extraordinary talent.

From the Bolivian norm, they become disadvantaged, because there are no programs in Regular Education that take advantage of their potential.

The unit responsible for carrying out the spirit of Law 070 is the Vice Ministry of Alternative and Disabled Education (VEAyE). It is part of the Ministry of Education. This Vice-Ministry establishes a national, operating framework in a way to cover attention to all sectors of society organically, which in turn allows for specific budgets and projects for its development.

In 2012, Law 223 in Poder Legislativo Estado Plurinacional de Bolivia (2012) was enacted, whose purpose is to guarantee rights and duties for preferential treatment under a system of comprehensive protection to persons with disabilities. The year 2014 enacts this law, specifying the benefits for people with disabilities. The year 2017 promulgates Law 977 in Poder Legislativo Estado Plurinacional de Bolivia (2017) to achieve the labour insertion of people with disabilities or their responsibility for minors with disabilities, or in case of people with severe or very serious disability create a monthly bonus for them.

According to data from the 2012 Census of Bolivia (INE, 2015), 3.4% of the population has some disability putting them at a disadvantage compared to the rest. Out of

a total of 10 059 585 inhabitants, there are 342 929 people with disabilities, see *Table 1*. The statistical data obtained from the Ministry of Education, there are 10 420 disadvantaged students enrolled in 2019 (Ministerio de Educación, Bolivia, 2019a) and (Ministerio de Educación, Bolivia, 2019b).

Table 1. People with disabilities in Bolivia

		Difficulty types					
Population	**inhabitant with disabilities**	**Visual impairment**	**Hearing impairment**	**Deaf problem**	**Physical impairment**	**Cognitive difficulties**	**Difficulty not specified**
10 059 856	342 929	188 036	59 454	37 452	68 073	29 550	15 719

The National Committee for Persons with Disabilities (CONALDEPIS), with information obtained from the Unified Registry System for Persons with Disabilities (SIPRUNPCD) and the Bolivian Institute on Blindness (IBC), provides the following information. By 2012 there were only 2138 people with some impairment (Comité Nacional de la Persona con Discapacidad, 2018). Also, from TIGO Bolivia (n.d.), 31% of people with disabilities are children and young people, that is, more than 100 000 children or young people with disabilities.

The data from the Census 2012 correspond better to reality; however, there is underreporting of people with disabilities, probably because culturally, there is a tendency to hide the disability. Before the enactment of laws that benefit and protect people with disabilities, the population finds the necessary encouragement to register by self or register their family members with impairment.

The VEAyE reports do not have information about ICT usage in education, what they report is enrollment in both areas: the alternative and for disadvantaged, the number of centres that serve the needs of this sector of the population and the number of teachers involved in the process. The VEAyE also reports the policies and programmes that are defined year by year.

From the objectives pursued by VEAyE, the one referred to ICTs stands out: „Incorporate and develop Information and Communication Technologies as strategies that guarantee quality in learning within the framework of cultural values" (UNESCO, 2010).

Some actions, activities, achievements or projects in education with ICT use for disadvantaged people are the following:

- Currently, in Bolivia, it was possible to incorporate nearly 20,000 people with disabilities in schools and colleges of regular education when, in 2006, the figure was 6,000 (Martinez, 2016).
- The VEAyE (Viceministerio de Educación Alternativa y Especial, 2018) and Sunkel et al. (2012), the year 2013, promotes the development of educational software for the disabled, through the Call for the First Hackathon for Inclusive Education. However, there is no information about the event results.

- The government through DS No 2950, of October 14, 2016; introduces the Program Community „Socio-Education in the Home for Persons with Serious and Very Serious Disabilities"; For this, teachers have been trained to meet the needs of this kind of students at home. This kind of students uses computers (provided by the programme) as a work tool and access to the Internet. Some experiences described in (Ministerio de Educación, 2017) indicate the use of playful software, to obtain cognitive and motor achievement, however, it is not precisely what they are.
- The international educational institution, Fé y Alegría (2019), developed a labour inclusion programme, They have six specialized education institutes in the technical training of young people with disabilities, and also establishes the link with companies that hire them after completing their training.
- TIGO telephony company, since 2014 has developed an initiative, aimed at the inclusion of people with disabilities. This initiative is carried out in agreement with directors of education centres for disadvantaged; TIGO adapts the environments and provides the technological material to convert the classroom into a digital classroom. They provide Internet access, tablets, Xbox Kinect consoles, plasma TVs or others. Besides, the training to educators, psychologists, physiotherapists and volunteers for the proper use of these tools. The beneficiaries of this project are approximately 3000 young people and children (TIGO Bolivia., n.d.).

In 2012 a curriculum was defined for the attention of students with intellectual disabilities, this curriculum specifies the areas of knowledge to cover, among primary study areas and technical alternatives (Ministerio de Educación, 2012a). In the document, there is no evidence of ICT use as a support tool. On the other hand, in the document (Ministerio de Educación, 2012b) describes the curricular and methodological guidelines of inclusive education in the field of disabled education, the presence of ICTs is as content in a training area, including computer teaching in the sense of the use of the computer.

The year 2014, the govern introduces the curriculum developed for disabled education has been introduced. Currently, there are already teachers with a bachelor's degree prepared to teach people with disabilities.

There are agreements, institutions and guidelines worldwide of the expectations about ICTs in disabled education. The 2017 UN in its section for education and culture has promoted the „First Regional Meeting on the construction of Public Policies on ICT for Persons with Disabilities", which has concluded on the basic need for the use of ICT for:

- Full accessibility to different media/resources/devices related to education and culture.
- Strengthening skills in people with disabilities for labour insertion.
- Promote inclusion in regular education.
- Support the fulfilment of the central object accessibility/availability of education that is to provide self-sufficiency and independence to people.

ICT should play a role in allowing accessibility/availability of educational resources to everybody. For example, to support blind or visually impaired people: turn everything visual into audible; in the case of deaf or hearing impaired people: turn all audible into visual, and so on.

In the case of Bolivia, we must take care of the obstacles to face:

Costs are prohibitive to disadvantaged sectors of the population.

Realities in some regions make accessibility to ICTs difficult.

Culture, the tradition in some sense can offer resistance to the use of ICT

On the initiative of the Universidad Mayor de San Simón, universities of the Bolivian system meet in November 2018, to concretize the creation of the Interuniversity Network of Inclusive Higher Education and Disability Bolivia (RESID-BOL). One of its objectives is to Promote synergies among participating universities by creating environments for the development of research, training and exchange of best practices that enhance knowledge on inclusive higher education and disability (Sobre todo personas con o sin discapacidad, 2018).

Teacher Training for Disadvantaged Groups

In Bolivia, the Higher Teacher Training Schools (ESFM) train teachers for primary and secondary school. There are specialization alternatives for teachers, which can reach the level of masters. The organisations where teachers specialize or get an update are ESFM (which also offers specialization courses), Pedagogical University (UP), Specialized Continuous Training Unit (UNEFCO) related to the Program of Complementary Training for Teachers in Practice (PROFOCOM). All these organisations depend on the Ministry of Education and organize the studies according to the Curriculum of the Plurinational Education System (Ministerio de Educación, 2012c), the pedagogical needs according to Law 070 (Estado Plurinacional de Bolivia, 2010) and contents of subjects established by the Ministry of Education.

The public and private universities in Bolivia offer training in the area of education for teachers. The training offered is a Bachelor of Science in Education; in some cases the offer of a postgraduate course in disabled education (which refers to the education of people with cognitive difficulties and physical impaired at a disadvantage for learning).

From the Ministry of Education in Bolivia for the 2019 administration offer from PROFOCOM (PROFOCOM, 2019). and in the UP (Universidad Pedagógica, 2019), there are no courses oriented to disabled education, for UNEFCO in (Universidad Unión Bolivariana, 2019) that corresponds to the training offer 2019 there are also no courses related to disabled education.

In contrast to the 2019 offer, by 2018 the Bolivian government offer for teachers, administrative staff, mothers and fathers of families, social organisations and the educational community for training courses and related to disabled education in (Ministerio

de Educación, 2018). The 2018 offer includes; Initial teacher training, specialization by subject area, bachelor's degree and master's degree in the area of education for teachers. The offer includes face-to-face, blended and virtual training; the offers face-to-face and blended learning in the Superior Schools of Teacher Training (ESFM) and Academic Units (UA) are published indicating the department or municipality where it is located in the Bolivian territory, since the teacher can choose the courses according to the area where they live.

In the offer shown in Ministerio de Educación (2018), is observed for a four-year cycle formation on disabled education for People with Disability. This offer is present in many locations around Bolivian ESFM's: ESFM-Trinidad (Beni). UA Simon Rodriguez (Cochabamba), ESFM Simon Bolivar (La Paz), ESFM Angel Mendoza (Oruro), UA Puerto Rico (Pando), ESFM Enrique Finot (Santa Cruz), ESFM Multietnica Indigena Enrique Finot (Santa Cruz), UA Gran Chaco Juan Misael Saracho (Tarija).

Also, in Ministerio de Educación (2018), courses offer for teachers in training: Training cycles in ICT for educational practice (50 hours) proposed by UNEFCO. They also offer courses for teachers in practice:

ICT training course offering 50 hours courses in: Basic office automation for teachers (use of computer and office automation, Internet use), Advanced office automation in educational processes (data protection, advanced office automation, multimedia educational use through internet), primary use of ICT in educational practice (ICT resources in knowledge by area of primary and secondary school subjects), technological resources of the classroom (use of ICT in the classroom, ICT tools for the specific subject area, ICT resources as a pedagogical tool)

Programming and robotics in scientific learning (150 hours), from basic robotics to design and construction of programmable robots.

Virtual courses of 50 hours, in ICT, to interact in the classroom, ICT tools by subject area of the curriculum, essential use of ICT.

The Pedagogical University (UP) offer in Ministerio de Educación (2018) has the following levels of training: Diploma Difficulties of learning with 800 hours (online course) and Master's Degree in Inclusive Education. Mention Hearing disability, Mention Visual disability, Mention Intellectual disability with 2400 hours. The offer of the Pedagogical University is no longer present in the 2019 administration. The detail of the subjects of these postgraduate courses is not visible. No additional information exists beyond the offer and evidence of these postgraduate courses in the virtual platform of the UP.

The disabled Education training that was offered by the government training bodies in 2018 is no longer available for 2019. One explanation for this behaviour may be, there are no requirements for new teachers in disabled education in Bolivian schools, the second may be that it is not an attractive training programme for applicants.

From the training offer of 2018 and 2019, there is no evidence of training in disabled education with the use of ICT. It is evident there are courses for training in ICT use

in primary and secondary schools with a pedagogical approach and appropriate to each area-subject, but not for disabled education.

In the public and private Universities of Bolivia, the current offer has been observed through their websites and observing their visible curriculum:

The Autonomous University of Beni José Ballivian offers the career of Education Sciences (Universidad Autónoma del Beni José Ballivián, 2012), with three subjects for disabled education without specifying the content (the subjects are called Disabled Education 1 to 3)

Universidad Mayor de San Andrés (UMSA) offers Education Sciences visible in (Universidad Mayor de San Andrés, 2019b), with a mention in psychology and the following subjects noticed psychomotricity and disabled education.

Universidad Union Bolivariana offers Education Sciences visible in (Universidad Unión Bolivariana, 2019), with subjects related to psycho-pedagogy, learning difficulties and a subject for disabled education.

Universidad Mayor de San Simón offers Education Sciences visible in (Universidad Mayor de San Simón, 2019), although there are subjects related to learning difficulties and psychomotricity, there is no evidence about training for disabled education as a specific area.

Universidad de la Salle offers a degree in Education visible in (Universidad La Salle, 2019), where the subjects related to ICTs in education have greater emphasis than in the universities programs mentioned above, and subjects related to disabled education but not as specific training for this area.

In the offers for training from the universities, although there are subjects related to psycho-pedagogy and learning difficulties, only some mention subjects related to disabled education.

Finally the UMSA offers a course,blended modality, in disabled education, visible in (Universidad Mayor de San Andrés, 2019a), whose curriculum includes: Neuroanatomical and Neurophysiological Bases: Perspective of Neuroscience and Neuroeducation in Disabled Educational Needs, Diagnosis and Early Identification of Children with Disabled Educational Needs (Instruments of Identification and Case Studies), Neuro Development of Children with Special Needs in Early Childhood, Analysis and Design of Rehabilitation Environments for Children with Disabled Educational Needs (Identification and Diagnostic Instruments), ICT and the Disabled Educational Needs for Integrating Education, The Facilitators Role in the Care of Children with Disabled Educational Needs.

The UMSA postgraduate training program at the graduate level and UP's master's program are the two specific offers regarding disabled education. From the first is a subject related to the use of ICT in disabled education, the second is unknown the existence of ICT content. In order to discover it will be necessary for an interview or request for more information to UMSA.

In Bolivia, although there are training schools for teachers, and offer of training in the area of education in the universities, the majority is oriented to education in a general

approach. According to the 2012 National Census (INE, 2015), 3.4% of the population are part of the group of people with some physical or mental handicap, and a part of it is in school age.

Challenges and use of technological innovation

The Ministry of Education in Bolivia launches annually, since 2014, the Educa Innova event to provide information on the experiences and best practises with ICT of teachers at the initial, primary, secondary, special and alternative levels. The thematic axes of this event are the use of technological tools in the curricular development plan, mobile devices as a pedagogical resource, Kuaa computers and classroom work, robotics in education.

There is no historical documentation of the Educa Innova event on the Ministry of Education's website[5], However, there are numerous press releases since 2014, such as Pomacahua, P. (2014), which highlights the teachers participation and the experiences they perform in one of the thematic axes and level of education; One of these experiences is the one mentioned in the press release (Jímenez, 2018), which refers to the work of Professor Richard Revollo approaching students to undertake innovation putting in practice what they learned in high school, making use of ICT as real solutions to various problems. The students of Revollo's teacher-developed mobile applications, with App Inventor 2 by the Massachusetts Institute of Technology (MIT), related to content seen in the subjects corresponding to secondary school. This experience is Retrieved from the ILCE Award for innovative teaching practices in Ibero-America and the Caribbean, an event in which he received an honourable mention[6]. This type of experience shows how teachers participate in Educa Innova sharing their experimentation of ICT application in the classroom; unfortunately, the lack of publication of these experiences in the Educa Innova, do not let to reproduce them as a multiplier effect in the colleges nationwide.

Another innovative undertaking is the experience of the NGO Ayni, which for 18 years has been working in the Andean region, mainly in Bolivia, on the development of educational initiatives. One of the initiatives developed by Ayni in Bolivia is the Learning By Creating project (Aprender Creando, 2019) that has produced, within its objectives, educational applications created by students, from urban and rural areas, according to their needs (Ayni Netherlands, 2019). The applications created were proposed by the student under the supervision of their teacher and developed a software with the support of university students of the UTO (Technical University of Oruro) of the Computer Engineering and Systems Engineering careers. The project developed approximately 62 educational applications. The developed applications need to be updated since several were made using

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

[6] See http://www.ilce.edu.mx/premio/ganadores2017/

Flash Player, which needs to be installed for the web browser and can cause security problems (the World Wide Web Consortium (W3C) does not recommend its use at present).

In Valda Sánchez et al. (2015), there is the experimentation of gamification with game dynamics and mechanics in non-game environments in a virtual education platform. This experience, according to the authors, achieved greater participation and exchange among the students, who must participate in the forums, assess and comment on the resources that other students contribute.

Most experiences in the educational field focus on the essential use of file management, surfing the Internet. Universities and the government have promoted the use of online education, making use of platforms like Moodle to carry out virtual and blended courses (b-learning).

The government's efforts focus on Internet access and devices such as computers and network infrastructure that can reduce the digital divide. Events like Educa Innova aim to encourage the use of ICTs by teachers, but it does not encourage the publication and reproduction of successful stories awarded during the event. According to Farfánet al. (2015) and Gallardo (2015), two studies in Bolivia about ICT usage in school, the first in the city of La Paz (urban area) and the second in the department of Tarija (urban and rural areas) shows results about the ratio of students per computer in school. In La Paz, the ratio of 16 students per computer to 17 students per computer in Tarija schools is observed, with the national average of 55 students per computer according to Gallardo (2015). The publication year of both studies is 2015, and the One Computer per Student project began in 2014, we must assume that the situation in this aspect has had to improve due to the time happened since 2014 and usage of technology provided by the government as noted in a press note (ERBOL, 2017a). Regarding ICT use, only Farfán (2015) has usage data and concludes that the most use of students is to seek information and entertainment. It also indicates that the existence of ICTs is evident, but not their use in the framework of teaching and learning. It is a priority to incorporate ICT in the curriculum.

In Bolivia, access to ICTs for the population in general and education has been a task of the last decade,s privileging the access by mobile phones to the Internet, and 100% electrification in the rural area is being worked out until 2025 and access to the fixed network at the national level. By having such high access to the internet from mobile devices, it has been discovered by the AGETIC ICT Survey, the users focus on the use of the mobile phone for communication (it is evident since it is a telephone) followed by the use of the internet to search for information and entertainment; while the few who have access to the internet from a computer (20% in urban areas and 4.2% in rural areas) use them for work and study purposes.

Currently, the Ministry of Education offers an online training course for teachers. These courses refer to essential use of ICT in educational practice, technological resources in the classroom, ICT for collaborative work. These courses differentiate by the specific subject (Mathematics, Language, History, others). For the objectives above mentioned,

it is understood to improve the knowledge of ICT tools for their use in daily pedagogical practice; it is intended to apply ICT tools correctly according to the subject. These courses are the evolution of teacher training that began in 2011 with training in computer management, office automation; Currently, the Specialized Unit of Continuous Training (UNEFCO) offers in-depth courses, which according to the subject allows them to create and adapt digital resources for the classroom. There are also advanced courses such as Development of educational projects with ICT, Research with the Internet: Resources and tools, Augmented Reality, Robotics in class, Multimedia projects (video, audio, image). This type of training to improve teacher skills on ICT for education, which was oriented to the instrumental use of ICT and not to its pedagogical and didactic application.

Technology as Blockchains for educational use, Digital narration as the production of teaching materials and learning, as well as the framework of Global Shared Pedagogy, are themes not worked or mentioned in the field of Bolivian education, neither at the universities nor the secondary and primary school. The search for information on the Ministry of Education websites, the universities, and recent publications in Bolivian journals do not present results for these topics.

The challenges currently focus on achieving access to the Internet for all Bolivians and specifically for teachers and high school students. The teachers have a train in the use of computer and software like office tool. They also have skills in educational applications such as GeoGebra Retrieved from the Kuaa and installed technological floors. With the teachers, a pedagogical approach framework of ICTs has not been deepened, which is one of the tasks that must be faced now; the baseline is the teachers have the necessary skills and have experience in the creation and adaptation of resources. Is a more critical challenge the experiences of teachers and the need to link the curriculum with the perspective of using ICT tools for teaching. These challenge goes beyond the use of technology, as shown in the conclusions of (Farfán et al., 2015) and the approaches promoted in (Voogt, 2008).

The commercial aspect of ICT in Education and Inclusion

According to (Centro de Investigaciones Sociales Vicepresidencia del Estado Plurinacional de Bolivia, 2016), the companies and NGOs working with technology and education offer advisory services, infrastructure implementation, training for teachers, generation of digital educational resources and pedagogical support for teachers and students. Some of the companies and NGOs are Quipus, Cognos, MingaDigital, Ayni, EducaTic (up to date has no data about its working since 2017).

Quipus[7] is a Bolivian industry involved with technological products and solutions. The assembly of computers and cell phones is the main activity of Quipus. The Kuaa computers assembly is a task of Quipus

[7] https://www.quipus.gob.bo/

The NGOs support the use and appropriation of ICT for education through teachers and students training, learning content production, socialization of the activities carried out and achievements.

Cognos (https://cognos.com.bo/uie/) is a company working with technology and education. It has an educational computer department offering solutions for education. The company offers the following solutions:

- Training for teachers: office automation for the school (OS Windows, MS Office), web 2.0 in education (aimed at knowing the web 2.0 and the advantages of applying it to education)
- CMS (Course Management System) with Moodle:
- Virtual classrooms for schools[8].
- Own Moodle platform for schools.
- Consulting in Moodle.
- Support.
- Courses and contents Moodle.

Minga Digital[9] is a programme of the Rotary Club Santa Cruz. It is a non-profit organisation, concerned with the improvement of education through access to knowledge and technological innovation, developing the ICT skills for educational practise in favour of teachers and students, training in ICT for teaching and learning for teachers. This organisation uses volunteering to teach computers, donations to cover equipment costs and others, support with an infrastructure that another organisation can provide. MingaDigital has been working since 2001 supporting public school units with technology. This support is about installing and maintaining computer rooms, implementing the curriculum with ICT, training teachers. The visible activities of this organisation are on Facebook (Fundación MingaDigital).

Cognos and Minga digital do not work outside of Santa Cruz. On the other hand, Ayni Bolivia (www.redayni.org) deals with the technological training of teachers and students. Some of the training activities carried out by Ayni are: computer management, content creation, seminars, competitions and technology fairs with groups affected by the digital divide (they cannot access technology easily) and improve their opportunities to access higher education and employment. It has a national scope of action. Currently, it has three programs running:

ICT Women: oriented to female students of the fourth, fifth and sixth grade of high school in peri-urban areas of Oruro. The program allows them to develop technical skills to generate their resources independently. They learn maintenance and assembly of computers (hardware and software) to face the current and future demand; it entails an income of economic resources. They learn the responsible internet and social network use

[8] http://www.redescuela.org

[9] http://minga-digital.rotaryclubsantacruz.org

to prevent human smuggling and trafficking, cyberbullying and data protection; they can transmit their knowledge to their peers „as equals", expressing themselves in their language, aware of their context and national reality.

Chaski: Implementation of 18 computer laboratories in rural areas, in order to introduce and strengthen the use of ICT in the classroom through technical, pedagogical and financial training; the development of educational content and school participation in the Open Door ICT Fair. The Digital Library with an ordered database of the material produced, among contextualized digital games for primary and secondary school, material in native languages such as Aymara and Takana, as well as some games in a mobile phone version (2009-2016). Learning and Creating is the methodology used to produce digital educational games. This methodology allows the Bolivian teachers produce games tailored to the student based on the national curriculum and its context and language. This project lasts for 15 years, and 74 schools distributed in the seven departments of Bolivia have participated. The training and digital material production benefited more than 8 000 teachers and 52 000 students. (2001-2015) Ayni is related to a Holland program, which focuses on support Bolivia to promote ICT in education (Ayni Netherlands, 2019).

These organisations claim there are difficulties due to government's lack of support towards these efforts; despite the verifiable achievements of Ayni, MingaDigital and COGNOS (Centro de Investigaciones Sociales Vicepresidencia del Estado Plurinacional de Bolivia, 2016).One of the most visible projects, which has worked successfully is the Chasky from Ayni. The built resources are Retrieved from (Aprender Creando, 2019).

The Plurinational Center for Alternative Distance Education (CEPEAD) (http://cepead.educabolivia.bo/), is an agency of the Bolivian state responsible for providing virtual training for the migrant population and also offers it at a national level for employees from public institutions and strategic organisations. The courses offered are free.

The digital economy information of Bolivia is highly scattered. To obtain reliable information is necessary to cross-reference information found in the contracting system of the Bolivian stat against the national tax system and Fundempresa. The ICT economy is an emerging sector in Bolivia, growing in importance. It influences GDP and contributes to the country's productive process. The universe of companies developing Software and ICT services products represents 51.81% of the Technology services market (the telecommunications sector included). Where those of Software development represent only 38% of the market, many of them export their products. The digital market in 2010 was composed of 612 companies and traded value of 55.8 million dollars, in 2016, the number of companies increased to 1 105 to 187.5 million dollars traded. This trading includes the sale of technology imported as well as the development of software for local use and export. The software development companies activities are to develop Website 40%, Web applications 20%, Mobile applications 24%, Software 48%, other 24% (Quiroga, 2017).

In (Centro de Investigaciones Sociales Vicepresidencia del Estado Plurinacional de Bolivia, 2016) and (Quiroga, 2017), there are references to the local educational software

industry. The experiences of Cognos and Ayni shows a need for educational software for the Bolivian school, and also succeed in producing digital media for learning support. The emerging and promising market includes the education sector (Quiroga, 2017).

National Recommendations for the SELI Project

The diverse geography with low, dense population and the main crowd cities in contrast to the scattered rural areas have made it difficult to connect to the internet to the whole country. The government efforts in recent years have been to bring Internet access to the entire territory; first through mobile telephony and after through optical fibre. The mobile telephony has more than 9 of the 11 million Bolivians connected to the Internet; on the other hand, the fixed Internet-only covers 20% of the population, being a lower percentage than mobile connection. The gap widens in the rural area where about 4% is connected to the internet by broadband. Bolivians use the Internet through mobile phones, mainly to communicate through social networks and not to work or carry out education activities. Finally, the low income of the majority of the population is related to low-level technology knowledge (46% of connected users).

Bolivia must work on the following suggestions: using the most common technological devices to include students in educational processes with ICT; promote the installed infrastructure use in schools; strength the adequate use of ICT in the regular curriculum; Include ICT in disabled education curricula and train teachers in ICT use.

The SELI Project challenge is to work on inclusion for the disadvantaged group as students and teachers from rural areas in the ICT use for learning. It does not limit work with the same actors in the urban area, where technology and access to the internet have penetrated better than in rural areas. However, access from mobile devices that allow some degree of interaction for education considering the penetration of this medium in Bolivia.

The inclusion by ICT goal of the project can support this disadvantaged group. The disadvantaged people, due to impairment (physical or cognitive) benefits from the Universal Design of Instruction (DUI) approach. In the country's educational, there is no knowledge about the ICT environment with DUI. DUI approach is useful to better manage the gap between the rural and urban areas, including native languages such as Quechua, Aymara and Guarani.

It is an opportunity to support and consolidate the education with inclusion in Bolivia with the open platform of education with inclusion proposed by SELI. The country is in the first stage of reducing the digital divide with 100% national Internet connectivity by 2025 and is also an effort to increase the use of ICTs in the educational field according to Bolivian objectives. The SELI team needs to know the low connectivity degree of technology penetration in society and education, and in advanced use is in the initial stage of work. The advanced use of ICT in education may be affected if national plans do not reach their objectives for 2025.

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ICT IN EDUCATION FOSTERING INCLUSION – THE BRAZILIAN CONTEXT

Abstract: This chapter presents an overview of the use of ICTs in the pedagogical process in the context of Brazilian schools. It addresses national policies for digital divide and Federal Government programs to encourage the inclusion of ICTs in the daily routine of the classroom. Shows the use of ICT in Education by identifying infrastructure problems as the lack of preparation of the teacher for the use of technology, poor infrastructure of the schools, lack of time and support. Provides data on disadvantaged people and projects to promote digital inclusion and points out problems in the education of educators. Despite these limitations it reports the state of the art of some didactic practices that use ICTs as support in the teaching learning process and discusses challenges in innovation especially global sharing pedagogy and digital storytelling. At the end discusses the main challenges for access to ICT in the different realities of Brazil and shows some recommendations for the SELI (Smart Ecosystem for Learning and Inclusion) project.

Keywords: Brasil, ICT, learning, inclusion, digital divide

Access to technology in Brazil

Brazil is a country of continental dimensions and with more than 200,000,000 inhabitants (IBGE, 2019), which means that there is naturally a great socioeconomic-cultural diversity. This diversity is also observed when looking at the aspects related to Technology.

The Institute of Applied Economic Research (Portuguese: Instituto de Pesquisa Econômica Aplicada, IPEA), published in 2019 a text for discussion on the estimation of Internet demand in Brazil (Mendonça and Silva, 2019). The text is based on the ICT Households research of the Regional Center for Studies on the Development of the Information Society – Cetic.br, whose objective is to investigate the access and use of information and communication technologies (ICTs) in Brazil (CETIC.BR, 2018). The text searches from statistical resources to determine the factors responsible for a domicile or not connected to the Internet and establish a model of demand for the internet, considering several types of connection: radio or cellular (mobile) via modem or 3G and 4G chip, cable TV / fiber optic, digital subscribe line (DSL) per fixed telephone line. The results indicate that social class, income and schooling are factors that influence whether or not the household is connected. The higher the level of education or income, the greater the effect on the probability of the household connects to the internet. Regarding the demand model by type of connection, no possible defined pattern of identifying the effect of a variable on the probability of choosing a type of connection was observed (Mendonça and Silva, 2019).

The text points out a number of considerations for further studies. Need to identify connection options in the area of the home, consider the price of internet services Retrieved from the area of the home and check whether or not there is connection in the area of the home. This is the first study to work with disaggregated data estimating the demand for the internet for the national context (Mendonça and Silva, 2019).

The Continuous National Sample Survey of Households (Portuguese: *Pesquisa Nacional por Amostra de Domicílio Contínua* - PNAD), a household survey of IBGE - Brazilian Institute of Geography and Statistics (Portuguese: I*nstituto Brasileiro de Geografia e Estatística*) that investigates, among other aspects, access to the internet and possession of the mobile phone for personal use, results in the percentage of households that used the internet rose from 69.3% to 74.9% from 2016 to 2017 , representing an increase of 5.6 percentage points. While cellular presence increased, from 92.6% to 93.2% of households in the same period. In addition to these other relevant data pointed out by the study are that 95.5% of users enter the internet to exchange messages by applications, 78.2% of people 10 years of age or older had cell phones for personal use. In homes with Internet, access by cell phone predominates, in 78.5% of households with internet broadband. Digital exclusion is identified by the study for 54.8 million people 10 years of age or older who have not used the internet in the last three months prior to the survey (IBGE, 2018a). The main reasons reported were: not knowing how to use the Internet (38.5%),

not having an interest in accessing (36.7%) and finding that the internet access service was expensive (13.7%) (IBGE, 2018b). In another recent IPEA study (2018), the authors add information that every 1% increase in internet access there is an additional growth of up to 0.19% of gross domestic product (GDP). According to this study the state of Bahia is the state more disconnected with 1.255 million people in 323 districts do not have a cell phone signal.

Study of the IBGE (2018b), raises important challenges in the area of education to improve access to the Internet in Brazil. According to the study, 75% of people considered disconnected say they do not use the network because of lack of knowledge or lack of interest. For the authors, public policies need to consider this information and, in addition to increasing the availability of the signal, provide actions that make the digital world more attractive to this part of the population.

Still according to IBGE (2018b), the number of people who said they did not access the internet because they did not know how to use the tool was equivalent to the number of people who claimed they had no interest. The high cost was also pointed out as an important limiting of access. The study concludes that even if there were infrastructure available throughout the country, there would still be a contingent of digital excluded, who would not know how to use the Internet. The authors emphasize that the lack of intimacy with the network is an important barrier to be considered.

The Inclusive Internet Index of 2019 (Pepper, 2019) seeks to measure the extent to which the Internet is not only accessible but also relevant to all, allowing the use that enables positive social and economic results at individual and group level, positions Brazil in the 31st position in a total of 100 countries. When the cut is made for Latin America, Brazil is only behind Chile and is ranked 2nd or 3rd place in the region in all major categories. For analysts, this year's study has revealed a stagnation in progress to overcome digital barriers. Internet connections in low-income countries increased by only 0.8% compared to 65.1% last year. On the positive side, this year's study showed that there was improvement in the inclusion of women and the disabled in low- and middle-income countries, driving progress.

For the authors it is necessary to focus on the prevention of digital exclusion in a collaborative way, involving government, private sector, academic, technologists and civil society. It proposes implementations of public policies, investments in infrastructure and exploitation of new technologies to give everyone access to the benefits of connectivity.

ICT IN EDUCATION — AN OVERVIEW

The Education ICT (CETIC.BR, 2018) research proposed by the Regional Center for Studies for the Development of the Information Society (CETIC.BR). The research had its first version in 2010 and aims to collect data in the school context with the objective of mapping the access and use of the technologies in the learning spaces generating

relevant and quality information that enable the development of effective public policies for the Brazilian reality. The research also aims to provide evidence to assist in the monitoring and implementation of proposals in the various educational contexts. The research conducted in 2017 also included information from schools located in country areas, portraying in a more reliable and comprehensive way the access, use and appropriation of digital technologies in the Brazilian school space. This expansion favors the promotion of qualitative and equitable access to ICTs.

According to the data of the 2017 edition, it is possible to affirm that internet access is widespread among teachers (97% of teachers teaching in schools located in urban areas said to use the device to access the network). Data on the use related to teaching and learning activities were: 53% of public school teachers reported receiving educational activities with mobile phone use. Among teachers of private schools, the percentage is 69%. From the students' point of view, the data show that there are inequalities in the national scenario. In the schools located in urban areas, 85% of the students were considered as Internet users (they accessed the network in the three months prior to the survey), when data separated by public and private school environment were considered, 22% of school students access only by mobile phone, a percentage that was only 2% among students of private schools.

As for the use of the device by students for school activities at the request of teachers, the data show the relevance of the device in the learning process: 53% among public school students and 60% among private school students. The use of cell phones can also be linked to the increase of the interaction between students and teachers beyond the school spaces.

The survey also provides information about the type of activities performed through the devices. Private school teachers reported: providing content on the Internet to students (48%), asking questions (42%) and receiving work or lessons through the network (29%). However, when the data on the use of technologies in the school environment are observed, the results show that only 39% of public school students in urban areas and 50% of those studying in private schools reported access to the Internet at school. As far as the use of the technologies for the accomplishment of educational activities, of the total teachers, 95% declared to request exercises for the students, for example, but only 40% said to make use of computer and Internet when they demanded this task to the students.

Finalizing the research analyzes the aspects that can influence the use of the technologies in the school space. For educators, lack of specialized training, infrastructure, reduced number of computers connected to the internet and available to students and quality of connection (40% of public schools Internet connection speed was less than 3 Mbps). Another relevant information was the fact that 95% of the public schools consulted had an Internet connection in the coordination or direction room, only 50% provided access in the classroom. Specifically in country areas, 36% of schools have at least one computer (desktop, laptop or tablet) with Internet access. In 61% of schools, the speed did not exceed 3 Mbps, and 16% had speeds below 1 Mbps. Among the main reasons for not using

the network were the lack of Internet access infrastructure in the region where the school is located (48%) and the high connection cost (28%). The research also investigated the participation of teachers in helping students in unpleasant situations occurring on the internet. According to the data, 40% of teachers said they have already helped students face bullying, discrimination, harassment and dissemination of images without consent.

In order to promote the digital literacy of Basic Education teachers, Brazil has invested a lot of resources in the last decades. A survey conducted in 2016 (Basniak and Soares, 2016) has proposed lifting the Brazilian publication of the last fifteen years in order to understand the effects of the National Educational Technology program in Brazilian schools. The results point out the difficulties faced in the implementation of technology programs that do not favor social inclusion in Brazilian public schools. Among the problems pointed out are the difficulty of access to equipment, inadequate or inadequate training of teachers for the use of digital technology. The authors emphasize the importance of having training policies that contemplate the agility of deployment and updating of equipment and not only the availability of technological resources. It is necessary to move from the technical, instrumentalist character for universal access to information.

Although there has been federal investment in teacher education since 1997 through specific programs (Programa Nacional de Tecnologia Educacional – ProInfo (Brasil, 2018b) e o Programa Banda Larga nas Escolas – PBLE (Brasil, 2008), for instance), the digital literacy of teachers remains a challenge to public policies. There is a need to change the focus of initial and continuing ICT training offered. Currently the technical domain of technologies is privileged without propitiating the development of the necessary skills so that the teacher can integrate the ICT to the pedagogical actions.

Considering digital literacy as a set of technical skills is the main misconception of public policies for ICT teacher training. This consideration precludes the necessary innovation of pedagogical practices. The training should focus on the methodologies of pedagogical use of ICT, valuing even the important moments of exchanges between peers (Brasilino et al. 2017).

With the purpose of motivating learning and promoting new classroom practices from new technologies, the Secretary of Education of the State of São Paulo presented in 2014, the Project Currículo+, with the aim of contributing to the continuous improvement of students' school performance and preparing them for the new challenges of the digital age. The project intends to focus on the pedagogical proposal, on the involvement and direct participation of education professionals in the structuring and implementation of projects with the objective of concretizing solutions, especially in the classroom. The proposal is to incorporate new technologies into the daily routine of the classroom, so that the network can accelerate the process of adopting new pedagogical practices, taking advantage of the possibilities that the technologies offer for student learning (Lopes et al. 2017).

The use of Massively Open Online Courses (MOOCs) has increased significantly in Brazil. The first use occurred in 2012 on the initiative of a public university. The number

of courses in the MOOC method in Brazil, although relevant, still needs to be better structured. One of the great challenges pointed out is the small offer in Portuguese of Brazil, which means that the rate of students taking courses in MOOCs is slightly less than 10%. The use is often similar to face-to-face courses, with the teacher taking responsibility for the teaching-learning process, using networking as support material in face-to-face classes. The theme needs more studies mainly to understand the causes of high dropout rates (Silva, 2017).

ICT for disadvantaged people in different countries & Universal Instructional Design

According to data from the Brazilian Institute of Geography and Statistics (IBGE), in the Demographic Census (2010), more than 45.6 million Brazilians reported having a disability, this figure represented 23.9% of the population (Brasil, 2010). If considered disability 13.3 million (7.0%) report having mobility impairment; 4.4 million (2.3%) have severe disability, more than 734,400 said they cannot walk or climb stairs and 3.6 million reported having great difficulty in getting around. Such data express the large number of users who need adaptations.

Centered on social inclusion and citizenship, Law No. 13,146, which instituted the Brazilian Law on the Inclusion of Persons with Disabilities (Statute of the Person with Disabilities), was approved in 2015 (Brasil, 2015). The law had the objective of ensuring and promoting, equally, the exercise of rights and freedoms for the disabled person.

Current understanding of disability must be based on an inclusive model, as well as assistive or supportive technology, products and services directed to the disabled need to propose solutions, methodologies, devices, which reduce the limitations of the person and the physical and social environment (Scatolim et al., 2016).

Since 2012, the National Research on Assistive Technology - PNTA, proposed by the Ministry of Science, Technology and Innovation (MCTI), by the Secretariat of Science and Technology for Social Inclusion (SECIS), at the Institute of Social Technology (ITS BRAZIL) survey on innovation in Assistive Technology in Brazil (Garcia e Galvão Filho, 2012). The research also aims to: Know the skills in Brazil in the area of Assistive Technology; map and characterize institutions in Brazil that produced research, services and products in the area of Assistive Technology; to foster the exchange of information among institutions, companies, researchers and users of Assistive Technology; to provide information channels so that people with disabilities and / or the elderly can benefit and obtain better knowledge about Assistive Technology research, services and products and more precisely enable the development of policies in the field of Science, Technology and Innovation, seeking solutions to improve the quality of life and social inclusion of people with disabilities and / or the elderly.

In 2014, the National Catalog of Assistive Technology Products (BRASIL, 2014), developed by the Ministry of Science, Technology and Innovation, was launched through the

Department of Science and Technology for Social Inclusion (MCT / SECIS) and carried out in partnership. In this way, public Internet access centers, technological literacy courses, and other initiatives aimed at minimizing digital exclusion among people with disabilities, the elderly, illiterates, indigenous people, the poor and teachers are being spread with the Institute of Social Technology (ITS BRAZIL). The catalog features products for intellectual, visual, hearing, physical, multiple and elderly disabilities. The purpose of the catalog is to provide access to information on assistive technology products, an online tool that allows the user to search for adapted products manufactured and / or distributed in Brazil. This initiative was intended to bring information, expand usability and accessibility, and consequently bring more quality of life to people with disabilities and the elderly.

In Brazil, digital divide came into effect, at the end of November 2005, with the digital divide project of the Federal Government, Computer for All (Connected Citizen Project). The country has mechanisms to promote social and digital inclusion: laws, specialized technological production, accessibility research centers. However, there are few public points of access to the internet prepared to receive disabled people.

The role of the Internet is fundamental for the realization of the autonomy and social inclusion of people with disabilities. The use of the Internet by the person with a disability directly interferes with access to education, work, fun and social relationships. Access to the internet facilitates the realization of some fundamental rights and may increase the participation of persons with disabilities as an active element in the construction and implementation of public policies. However in the Brazilian reality, most of the Internet sites have accessibility barriers that hinder or impede the access of the disabled to the digital universe, limiting access to education, leisure, work, information and social interaction (Costa Filho, 2014).

Also seeking to understand access to the internet by people with disabilities, the National Survey by Household Sample brings the information that 57% of Brazilian citizens with disabilities frequently use the Internet.

The city of São Paulo, Brazil's largest city, offers some services aimed at the digital inclusion of people with disabilities. The Digital Accessibility Seal proposes to certify sites and electronic portals that meet nationally and internationally established accessibility criteria. The Central Intermediation Center in Pounds (CIL) allows people with hearing, deaf and deafblindness to have accessibility in any public services in São Paulo city.

The Innovation Center for Brazilian Education presents an overview of the production of Brazilian research on the subject of education for people with disabilities. According to Isotani et al. (2018), 80 studies with empirical evidence were found, with positive results with the use of technology in education (96.3%). Among the most used technologies are software (61%), followed by digital games (13%) and hardware (12%). Most studies address visual impairment (47 studies), followed by cognitive / intellectual (32%) and auditory deficits (24%). Most of the technologies proposed have as target audience the students (76%). Only 12% are directed exclusively to the teacher. And another

12% are for students and teachers. The main focus of the studies were: management of education and techniques related to ways to manage and manage the educational process; evaluation of tool, method, process among others.

Regarding special education, the knowledge area with the highest incidence of studies is Portuguese (19 studies). Only 24.8% of the technologies covered in the studies are available for community use, with free and open access. The major challenge was the lack of studies on the development of tools and methods that benefit the least-enlightened public - speech deficiency, autism, and ADHD (Attention deficit hyperactivity disorder) - and focus on assisting teachers in the teaching of people with disabilities (Isotani et al., 2018).

In the educational context recent perspectives consider the use of ICTs in the classroom and at the same time offer a methodological transformation in teaching is through hybrid education. In this proposal, instructional design is an indispensable tool for the implementation of hybrid education, or even to better scale the transposition of traditional classroom teaching to the hybrid configuration. Nevertheless, Instructional Design is not a theme commonly addressed by Brazilian researchers, as shown by Barbosa et al. (2015), by performing a systematic mapping with the intention of characterizing the use of Instructional Design in research in the area of informatics in education in Brazil.

The Universal Design for Learning (UDL) is a recent area of study in Brazil. The basic proposal of the UDL suggests the access and guarantee of learning to all students in the school context, from offering multiple and varied ways of organizing and making available scientific knowledge. The use of technology in education makes the student more independent and autonomous in tasks (Alnahdi, 2014), lowering methodological barriers and allowing the same curriculum to be applied to all students, but with personalized goals, methods, assessments and materials. By lowering these barriers, UDL allows students to develop superior mental processes and metacognition as it fosters interaction between instruments (external objects) and signs (internal objects) so that they can learn to learn, which is one of the great goals of education (Plestch, 2009). In this perspective, the use of ICTs is recommended for teacher - student mediation and digital resources to facilitate understanding of the concept, offering support to the student in order to compensate for what is not fully functional.

In a study carried out in a private school in Brazil, with a blind student enrolled in the ninth year of Elementary School II, the author aimed to investigate the quality of the inclusive work offered to the student in question (Oliva, 2016). He concluded that of the three teachers who were part of the research, two totally disregarded the needs of the student and gave their classes without making any adjustments in the methodology, such as reading what was written on the board, so that the student could register through the ruler and puncture in the notebook. In addition, certain practices used infantilized the student and did not favor the learning of academic concepts. The author also noted that the school possessed some accessibility features that were not even used by teachers.

Distance learning has undergone great changes, accompanying advances in communication and information technologies. In Brazil, researchers have investigated methods to evaluate the benefits of e-learning from a variety of perspectives.

A study carried out through an online program offered to 291 students from public and private institutions in various regions of Brazil that aimed to understand the process of student satisfaction in the virtual learning system (Machado-Silva et al., 2014). The results showed that variations in the quality of the system, quality of information and quality of service influence the use of the system, and the construct User Satisfaction had 89% of the variance explained by the Quality of Information and Quality of Service.

For the authors, many of the benefits of distance learning programs are related to student satisfaction and the intensity with which they make use of the learning system (Machado-Silva et al., 2014). With the awareness of the antecedent indicators of these variables, education executives can plan investments that meet the most significant demands and use the information to deal with one of the biggest problems in distance education: the evasion rate. Future research should study this matter lengthways.

In another study conducted at a public institute of education technology, Oliveira et al. (2015) evaluated the use of the e-learning environment as a driver of the degree. While e-learning has helped solve students' mobility problems, there are notable problems with drop-out rates for virtual courses. The solution of the study aims to reduce abandonment rates, adopting different learning methodologies, re-designing the learning environment and using tools to support this new methodology. According to the hypothesis, the new learning environment adopting a student-centered approach will give students a voice and give them an active role in their own learning process. Therefore, students' needs, abilities, interests, and learning styles are used to determine classroom activities and therefore will help reduce dropout rates.

A study on hybrid teaching at the Clayton Christensen Institute in 2018 shows that 79.1% of the 110 Brazilian respondents point to high quality professional development for teachers as the main challenge for the use of technology in schools (Fisher et al., 2017). Connectivity and infrastructure appear next, with 62.7% and 41.8% of the citations respectively. The study characterizes the respondents, among the 110 participants, 50% were private schools, 24.5% were state and 24.5%, municipal, distributed among 19 states. Among respondents, 72% were teachers, 23% coordinators, 12% principals and 14% others. The most used hardware, according to the study, were cellphones and smartphones, with 94.9% of citations, Windows desktops with 28.2%, Windows laptops, 17.3%, and tablets: iPads, 10.1% . A majority, 79%, said that online learning is connected to offline activities, according to the survey. Although participants say that online learning occurs in most schools, only 57% of respondents said that students actually engage in this type of learning in a typical week of classes. Teachers' responses also show that they are more likely to use technology as a supplement to traditional teaching, as more than 70% reported maintaining instructor-led lectures in their classroom model. Of those interviewed, 72% said that using

technology improved students' emotional and social learning and 79%, that students had a greater involvement during the activity. Of the total, 49% said the technology had produced the expected results and 46% said it was too early to respond.

The study also proposes five recommendations aimed at the Brazilian schools to increase the effectiveness of hybrid education: to make sure that the data produced in online learning based on the computer lab or at home are integrated into the classroom; designing learning models with infrastructure constraints in mind; provide professional development with a focus on teaching, not just technology; ensure that the right metrics provide useful information for learning outcomes, and harness nonessential areas or disciplines to experiment with new technologies or hybrid teaching models.

Education for educators of disadvantaged groups

There are few researchers with production in the area within the Brazilian reality. A systematic literature review by Amiel and Oliveira (2018) on technology-related teacher education results in the recognition that there is a diversity of technologies and media used in teacher education (use of computers, mobile devices, educational software, social networks, among others). The study points to three experiences in which training took place without the focal use of new media (through discussion groups and reporting on teaching practices, for example). The study identified classroom, online and hybrid training. The proposals identified were incorporation of assistive technology for physical education teachers, training of foreign language teachers in ICTs, experiences for mathematics teachers; training for kindergarten teachers, free software training. Among the adopted media, we identified uses of laptops, programming languages, educational software, mobile devices, social networks, Internet publishing tools. There was greater coverage in training offered to public education networks by government programs and also in training directed to specific audiences.

Regarding the knowledge generated by the investigated studies, the authors emphasize that: The most recurring problems for conducting training are the lack of preparation of the teacher to use technology, poor school infrastructure, lack of time and support. There is a tendency for teachers to replicate traditional methodologies in classroom practices. The mobilization of knowledge about technology does not directly produce a transformation in pedagogical practices, as they are also impacted by teachers' working conditions.

The authors emphasize the importance of using Virtual Learning Environments (VLEs) not only as repositories of materials, but consider it necessary to invest in building bonds and social capital among users of the virtual environment. It is necessary to consider the knowledge of teaching and its context of action and to make joint decisions in the design, planning and execution of training activities. They recognize the need to encourage collaborative production, autonomy and authorship in the online environment. They emphasize that there is a demand for the implementation of long-term

training that promotes individual and collective dynamics of reflection on pedagogical practices and critical appropriation of technology. To conclude, the authors point out that: Most studies deal with specific experiences linked to programs and do not offer permanent support to teachers after the end of activities and it is difficult to systematize data and generate cohesive knowledge due to lack of information.

Another study conducted by Ferro, Reis and Anjos (2018), from the perspective of educational inclusion aimed to analyze teaching practice in the inclusive proposal from the process of teacher education. The main results of the study were the teachers' lack of knowledge of which path to take to make teaching meaningful to students. The difficulty in deciding what to privilege in the acquisition of new knowledge and the limited number of professionals who start from theoretical bases for the development of grounded practice. In conclusion, the study reinforces that the teacher builds his practice based on an idealistic perspective, taking an individual path.

The Center for Innovation in Brazilian Education launched in 2019 an initiative for educators themselves to understand where they are and how they can improve their skills. Available on a specialized digital platform that facilitates the search for educational technologies, the tool called Digital Teacher Skills Self-Assessment can be used free of charge for any public school teacher. The diagnosis is generated from a questionnaire that includes three areas: Pedagogical, Digital Citizenship and Professional Development. In the pedagogical area, skills such as practice, customization, evaluation, curation and creation are evaluated. Digital Citizenship focuses on responsible use, critical use, safe use and inclusion. In professional development, the tool focuses on self-development, self-assessment, sharing and communication.

Challenges and the use of technological innovation Global Sharing Pedagogy and Digital Storytelling

ICTs can favor new methodological practices in education. With the collaborative tools support one can promote experiences that will enrich the process of teaching and learning of school contents. In this context, it is necessary to create pedagogical strategies capable of mobilizing teachers and students in different times and spaces, in a collaborative perspective (Silva and Castro Filho, 2017).

Collaborative work is facilitated with ICTs through free online tools such as Collabora (https://www.collabora.com/), Socrates (http://www.virtual.ufc.br/socrates/), Google tools, AWS tools, Microsoft tools, among others. These tools support groups of students to exchange information and make decisions together. In this way, it encourages students to share their opinions, resolve conflicts during decision making leading to collaborative learning (Ishikawa et al., 2018)

In Brazil, some punctual efforts have been made to work on elements in the teaching-learning process that integrate active student-driven knowledge creation, collaboration,

networking, and digital media competencies and literacies, the four elements of global sharing pedagogy. The aim of global sharing pedagogy is to promote students' engagement in learning and connect formal with informal settings (Niemi and Multisilta, 2014).

The active methodologies such as use of Serious Games, Flipped Classroom, Problem Based Learning (PBL), Computer-supported Collaborative Learning (CSCL), Digital Storytelling propose innovative and motivating classes, as well as work the autonomy of the student, helping him to assume a greater responsibility for his learning.

Ishikawa et al. (2018) presents the contributions that Collabora can bring in the process of teaching and learning applied in Probability and Statistics course in Higher Education of a Federal University. Using CSCL, students worked on communication (exchange of ideas), coordination (planning and monitoring of activities), collaboration (negotiation between peers) and perception (exchanges of information regarding activities, tasks, time, feedbacks). Silva and Castro Filho (2017) describe the accomplishment of a collaborative project with students of the 8th year of Elementary School II in a public school. The experiment highlights a collaborative work carried out by the students with activities that integrated the Portuguese Language, English Language, Mathematics and Science disciplines, using the Socrates collaborative environment, developed by Brazilian researchers and already known by the teachers of the school where the experiment was applied. The activity to be worked on was the planning and execution of the Science Fiction Project: Myth or Reality?, that discussed aspects of literature based on the work Journey to the Center of the Earth by Jules Verne. The learning took place from the students' action in their daily living environment and appropriation of the culture of their group, mediated by teachers, colleagues, technological resources, and environment.

In Brazil there are few reports in the literature about the use of Digital Storytelling in Education, that is, the art of storytelling with a range of multimedia resources. But there is an effort to train teachers to use digital technologies allied to teaching and learning processes. Multimedia resources such as videos, audios, images, animations enable a differentiated and motivating way for students to learn (Silva et al., 2018). The authors present a methodology to bring digital technologies closer to the school context, through the continuous training of the teacher to use the technological resources Retrieved from the school. The goal is to include Digital Storytelling in teacher education as support in the construction of knowledge. It is believed that this technology, when employed in the classroom in a project format, can collaborate in the dissemination of contents and the development of skills and abilities, such as: problem solving, autonomy, communication, collaboration, creativity and innovation. The approach combines Digital Storytelling and Flipped Classroom. The methodology was developed to be used in elementary school, with the purpose of supporting the dissemination of content and the development of students' skills and abilities. Digital Storytelling productions are composed of four stages: planning, pre-production, production and post-production. Video edits can be made with Cinelerra video editors (http://cinelerra.org/) or

Avidemux (http://fixounet.free.fr/avidemux/). After the training in the tool, the teacher chooses a theme and elaborates its history going through the four stages of production. From this production, the teacher is instructed to make it Retrieved from a space reserved in the Marialina repository (sites.google.com/view/marialina). Marialina is an environment developed to bring together a range of Educational Resources, categorized by courses and levels of education, to support and improve learning. Joining the Flipped Classroom approach, the teacher guides his students to search the Digital Storytelling produced and stored in the repository before class. During the class, the teacher clarifies the doubts, induces questions about the content, carries out fixing exercises, taking the time to launch challenges and develop projects with the students, in order to deepen and consolidate knowledge. After class, the teacher evaluates the process and decides, or not, to add new topics to the theme (video). When the article by Silva et al. (2018) was written, the methodology proposed had not yet been tested in the school and was pointed out as the next step to be performed.

Marques and Cordenonsi (2017) report an experience with the History course in High School, where new educational technologies were used as an alternative teaching. This experiment was carried out in a public high school in the city of Restinga Sêca, State of Rio Grande do Sul (Brazil). From the initial theme, which were two revolts occurred in the first republic of Brazil, the Cangaço and the War of the Canudos, the students, through the use of Twine software (interactive storytelling application) and Storybird (application that enables the building interactive stories in the form of a digital book) have produced two games, with interactive stories. The teacher provided an introductory text and from it, the students created their productions that instigated the others to know the historical context occurred in the early twentieth century. The production of the game with interactive stories confirmed the protagonism of the students that during the development of the game was forming a warm debate on the various social problems that are evident in contemporary Brazil. Even though they were simple language software, initially some students had difficulties to appropriate the basic knowledge for the use of these softwares, and in some cases, few knew how to use the technological tools besides social networks, since the school still cannot afford the access and permanence to the use of ICT in teaching practice. After the experiment, the authors concluded that there are some difficulties for the effective use of the technologies in the curricula, one of them concerns some teachers graduated in specific degrees. Work in an interdisciplinary and technology requires that the teacher knows more than one area or has a strong integration with the teachers of the other disciplines. Research has shown signs that the pursuit of such integration in many cases is not the wish of teachers.

With the idea that Storytelling is a way to convey events using words, images and sounds, often by improvisation, Santiago et al. (2014) present Mogre-Storytelling, a solution for interactive Storytelling targeted to children and young public. This tool aims to be intuitive, providing different functionalities for the creation and customization of 3D

scenarios, allowing the addition of 3D models from the Internet and even to enable the creation of virtual stories using multimedia elements such as speech bubbles, sounds and images. The development of Mogre-Storytelling was carried out in Brazil in collaboration with the educational services from the Madeira Whale´s Museum (Portugal). Mogre-Storytelling was proposed as a supplementary tool in order to allow young students that regularly visit this museum to demonstrate their knowledge acquired after the visit. In order to assess the functionalities and educational potential of the developed application, the students created a text with a thematic story so that they could build up afterwards a 3D story using Mogre-Storytelling. The creation of this text aimed at developing their creative and collaborative writing skills. Besides, the background story aimed at providing an environmental awareness concerning the marine biodiversity, which is one of the main goals of the Madeira Whale´s Museum visiting classes. Most of the users needed initial instructions before the first utilization, in particular, concerning the localization of the available functionalities, mouse control and keyboard for environment navigation and visualization. In general, the students considered the application as entertaining.

The inclusion of global sharing pedagogy and Digital Storytelling in Brazilian schools needs to overcome some challenges. On the one hand, most public schools cannot provide access to and use of ICTs due to a lack of infrastructure. On the other hand, there is a lack of specialized training in the use of ICTs for teachers who are often unaware of the technological resources available to complement their classes. The proposal of Silva et al. (2018) is an attempt to train teachers for the use of digital technologies allied to teaching learning. But this is an initial and small work if compared with Brazilian context.

Despite the government's efforts to promote digital inclusion in the learning process through programs such as ProInfo - National Program for Continuing Education in Educational Technology (Brasil, 2018b) and PROUCA - Program One Computer Per Student (Brasil, 2017a), the use of ICTs is not yet present in school daily life. Although the use of ICTs brings people from different places, it is necessary to know how to use the tools properly, to select the information contained in the network. This is still a challenge for most Brazilian teachers.

Even though training in the use of ICTs has taken place and resources are available, teachers feel insecure in integrating ICTs into their lesson plans as a pedagogical resource. Even with the resistance of ICTs by most teachers, the reality of many schools has changed significantly through the inclusion of ICTs (Costa, 2015).

National recommendation to SELI Project

In Brazil, the issue of access to Information and Communication Technology (ICT) faces many different realities depending on the purchasing power of families (there are public and private schools), the geographic region of Brazil in which the school is inserted, the difference between schools of large cities, small cities or countryside.

While private schools and those located in the richest regions of the country have access to a fairly large number of ICTs and trained teachers, public schools generally have fewer resources coming from federal, state or municipal governments. This reflects the lack of technological digital resources (computer labs, internet access, technological devices) for use in schools and the lack of training of these teachers in the use of ICTs.

Another question concerns the number of weekly classes these teachers teach to supplement low wages. A teacher can often teach classes in three different shifts in three different schools. Of course, these teachers do not have the time to pursue professional development courses, nor to prepare digital educational materials.

Although there are technological resources, teachers are often not prepared either to use digital learning objects or to construct their own learning objects, in addition to resisting the use of ICTs. This is due to the fact that during undergraduate, either in Pedagogy or Graduation Courses that prepare teachers of Childhood Education and Elementary School, the students have little or no contact with courses that approach the technology issue. In addition, many teachers have been working in the area for over 10 or 15 years, during which time the greatest technological transformations in education have taken place, and there are few available mechanisms for instructing on new technologies.

Allied to this, the Brazilian public policies are focused on the distribution of equipment or financial resources, but they don't provide orientations on its use. These policies also recommend that a computer lab be created, already present in 76% of Brazilian public schools. However, these spaces are used to teach computer programs, which many students already know. Ideally, knowledge about the use of these resources will serve as support for traditional subjects within the classroom. For this to be done, it is essential that these resources be Retrieved from the classroom throughout the class period and not only for temporary use (Instituto Net Claro Embratel, 2015).

As if these problems were no longer serious and important enough, it is necessary and fundamental that digital inclusion and accessibility be contemplated in the Brazilian context. Since 2015, Brazil has laws that deal with accessibility, such as the disability status, also known as LBI ("Lei Brasileira de Inclusão", in English - Brazilian Inclusion Law). The LBI came to complete Law No. 10,098, and was inspired by the protocol to the United Nations Convention on the Rights of Persons with Disabilities, which took place in 2006. This law aims to ensure quality education for the disabled, placing them safe from all forms of violence, neglect and discrimination. Thus, people with disabilities are inserted in schools together with typical people and should receive special care so that they can have access and assured rights in relation to learning.

However, there are some projects that try to minimize these problems, such as:

- UCA "Um computador por Aluno" Project (One Computer Per Student Project): was implemented with the objective of intensifying information and communication technologies (ICT) in schools through the distribution of portable computers to students in the public school system. It was a project that complemented the

actions of the Ministry of Education and Culture (MEC) regarding technologies in education, especially the computer labs, production and availability of educational objectives on the internet within a project that promotes the pedagogical use of information technology in the network primary and secondary education in Brazil as a whole (Brasil, 2017b).

- Banda Larga nas Escolas (PBLE) Project (Broadband in Schools): which encourages telephone companies to offer internet connection infrastructure in public schools (Brasil, 2017c).
- Portal do Professor (Teachers' Portal): virtual environment with educational resources that facilitate and dynamize the work and a space for exchange of experiences between elementary and middle school teachers. The content of the portal includes suggestions of classes according to the curriculum of each subject and resources such as videos, photos, maps, audio and texts. In it, the teacher can prepare the lesson, inform about the training courses offered in cities and states and in the federal area and on the specific laws (Brasil, 2018a).
- Salto para o Futuro (Jump to the Future): A program aimed at the continuing education of teachers and managers of Basic Education, is part of the TV School grid and has as a proposal to discuss different trends in the field of education and contribute to the reflection of the practice in the classroom, using different Media: TV, telephone, electronic posting site, forum and e-mail (Brasil, 2018c).
- Banco Internacional de Objetos Educacionais - BIOE (International Bank of Educational Objects): Collection of educational objects of public access, in various formats and for all levels of education. Objects are accessible either in isolation or in collections (Brasil, 2018d).
- Public Domain: Portal that proposes to be a virtual reference library for teachers, students and interested in general. The environment allows free sharing of knowledge and promotes access to artistic, literary and scientific works in videos, photos and texts that are already in the public domain, according to Federal Law No. 5,988 (Brasil, 2018e).

For changes to take place in this context, some action is needed. First, there is a need to improve the structural conditions of schools, with good quality internet connections, and full support of IT professionals. In addition, the number of computers (and their distribution) must be considered so that they are present in the routine of students and teachers (and not in computer labs with restricted and eventual access).

Another fundamental point is the training of teachers, in order to offer training in the use of ICTs, thus reducing resistance. Thus, it is essential to update the courses of Higher Education (Pedagogy and Graduation Courses), so that the TICs become part of the academic curriculum of these courses. And as it is a constantly changing subject, it is also important to invest in continuing teacher education, that is, to offer digital courses and tools for career educators to teach them about innovations and how to use them to compose materials education.

Thus, it is very important to invest in national and international research projects either for the training of teachers or for the provision of appropriate platforms and tools for the creation of digital material (digital learning objects) by teachers. In addition, it should be thought that these trainings, platforms and tools should address accessibility issues.

However, it seems that Brazil has a lack of authoring tools and platforms that make it possible for teachers to construct accessible didactic material, since no research in this field was found in the national scenario.

In this way, SELI can address the gaps contained in the Brazilian context of Inclusive Education and the production of digital educational material. SELI has as one of the assumptions the availability of an authoring tool so that teachers can, with some ease, use to create their accessible digital materials and make them available to their students. Furthermore, SELI will help to improve the digital literacy among the teachers so that they can complement pedagogical content with ICTs in an appropriate and accessible way. Teachers should focus on pedagogical methodologies for the use of ICT. SELI will also support teachers in the production of instructional materials with accessibility.

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DIGITAL INCLUSION IN CUBA. CHALLENGES AND EXPERIENCES

Abstract: Cuba is gradually developing a computerization process of its society, by which all social and economic spheres receive inestimable benefits. The educational sector is revolutionized with the appearance of new technologies for learning. Pedagogy is being improved as new ways of teaching and learning appear with the use of digital resources.

Digital inclusion of all groups and sectors that for one reason or another have limitations for access to ICT, is among the main objectives of Cuban society. The present chapter ventures into this issue and systematically exposes achievements, projections and barriers still existing for the

gradual digital inclusion of the disabled, elderly, women, children and young people from rural schools in remote areas. Educational experiences that have been obtained are addressed, as well as pedagogical and technological challenges that still need to be resolved in order to reduce the digital divide in Cuba.

Keywords: Cuba, ICT, education, Digital inclusion

Information and Communication Technologies in Cuban education

Computerization in Cuba is a process that advances in a growing and organized way. As part of the update of the Cuban economic model, the government has established that this objective is an urgent need to achieve development. Converting ICT into productive forces is a guiding idea present in all legal documents of the central agencies of the State.

For this reason, the country is making enormous efforts to develop its technological infrastructure, invest in the development of human capital, expand the range of services and utilities that technologies can provide in society and begin a gradual deployment in the Cuban software industry.

In this sense, the country's management has early identified the convenience and necessity of dominating and introducing ICT into the social practice and achieving a digital culture as one of the essential characteristics of the new human being, for fair, equitable and sustainable development.

Despite having well defined and implemented policies and having obtained significant achievements in computerization, Cuba has not yet been able to advance at the desired pace in access to the Internet, motivated by the unfair economic blockade policy to which it has been subjected by the government of The United States. This fact has had a great impact on the fact that this service still has a high cost for the country and the population in general.

However, since the late 1990s, many institutions such as universities, companies and organizations have already accessed this service via satellite at no cost to their workers, but it is not until 2013 that a gradual expansion process began, associated to the connection via an underwater cable with Venezuela and the investments that the State began to make in infrastructure and digital services.

This made it possible to start browsing rooms in 2013 ,joining more than 600 existing Youth Computer Clubs. It also allowed to advance a Wi-Fi zone development program throughout the country and to considerably expand mobile telephony and start a process of development towards digital television.

According to data published in the television program Mesa Redonda broadcast in December 2018, the country currently has 1.3 million landlines and 5.3 million mobile lines; 670 navigation rooms and more than 1200 public areas with wireless or wifi connection to

connect to the Internet, covering all municipalities. The accounts for Nauta Hogar navigation, connection by ADSL from home, exceed 60 thousand and 1.9 million permanent Internet connection accounts; the email accounts are around two million 785 thousand and with the opening of the mobile data service, 1084 radio bases have been installed for the connection by 2G and 789 radio bases for the 3G that embraces 66% of the population. There are more than 34,000 entities with connectivity and 17% of them with broadband.

In July of 2017, the Ministry of Communications of Cuba establishes the „Comprehensive Policy for the Improvement of the Computerization of Society in Cuba", which is the guiding document for the process of computerizing society in a safe and sustainable manner. It has been conceived in correspondence with the set of policies and actions as part of the updating of the Economic and Social Model in the country. (MICOM, 2017)

This program has the following implicit objectives:

- Implement the National Computerization Program, which integrates and harmonizes the main priorities of the country in the short, medium and long terms for each sector of the economy and at a territorial level.
- Implement the National Computerization Program, as part of the National Economic and Social Development Plan until 2030, taking into account that it corresponds to a specific objective of the Infrastructure Strategic Axis and to define the system of indicators that allows its impact to be evaluated.
- Implement the National System of Technological Safety.
- Design and implement the Integrated Human Capital Management System.
- Reorder the productive and services activities associated with the software production and marketing sector.
- Improve management mechanisms, updating, socialization and marketing of services, digital content and computing devices, aligned with the Social Communication Policy.
- Develop and modernize the technological infrastructure, paying special attention to the deployment of broadband and the production of computing devices in Cuba, giving priority to the industry and the productive sectors with an impact on society.
- Promote the equipment industry linked to ICT, encouraging the participation of foreign companies.
- Implement the mechanisms that organize and encourage international cooperation in order to strengthen the development of ICT in a safe manner.
- Reorder the computer activity, establishing the required organizational transformations that foster the integration and management of the processes associated with the computerization of society, at the highest political and government level.
- Improve the legal, regulatory and normative framework that ensures the production, use, interoperability, certification, security and commercialization of ICT.

2019 is emerging as a year in which the country is committed to a greater generalization of its services and computer applications as part of a plan of measures to

strengthen the national software industry. This plan is made up of thirty non-state entities and forms of management embracing a better level of resources and the potential to contribute in a more decisive way to the development of computerization in the country.

Currently, Cuba is moving towards the establishment and development of Electronic Government, with the aim of increasing its effectiveness and efficiency in its management and also achieving greater accessibility for citizens in the use of ICT. As a result of the digitalization program of television, so far more than 120 transmitters have been installed in the provincial capitals that already enjoy a high definition signal; and more than seven million inhabitants, 63% of the population, have a standard definition signal.

In general terms, it can be said that the level of Cuban information literacy, despite the limitations with access to the Internet, for the reasons explained above, is generally high. Cuba has paid special attention to the development of scientific potential in computer sciences, as revealed by the figures of graduates of the University of Computer Science (UCI), of the polytechnics of Computer Science and people who have achieved self-learning by having computers as a working tool.

We must also highlight the impact of the Youth Computer and Electronics Club, which emerged in 1987. It consists of a network of technology centers, with 600 facilities present in all the municipalities of the country, playing a decisive role in the socio-cultural life of the community. They offer various services and courses of preparation in the computer sphere to the Cuban family and have graduated more than 40,550000 people in 30 years, which is why they constitute a referential entity in the digital literacy process of the Cuban society. (Martínez García, 2016).

There are still pieces of knowledge and skills that have been associated with the rapid development of ICT and the access of the population to the Internet; that is the case of online applications or operating systems for mobile telephony, which the population quickly begins to familiarize with.

Cuba is a country recognized for its high development of scientific capital. In the area of Education, it is recognized for having a consolidated policy and the prestige of professionals in this sector, is taken as a reference in many parts of the world; hence, our country extends its borders to collaborate in the educational sphere for the claim of different nations.

For many years, ICT has been a priority at all educational levels, and it can be said that the computerization of educational institutions has had a stable development. However, ICT in education has also suffered the impact of the policy of economic blockade to Cuba and access to the Internet has been introduced and generalized for a short time.

In 2007, 100% of the primary, secondary and pre-university education centers had personal computers grouped in computer laboratories that teachers and students accessed for their academic training, prevailing the connection in local networks. Between primary and secondary education, there were 11432 centers and 3215 centers in pre-university education (ONE, 2007). Currently, an investment process is being carried out to replace the computer equipment, which is 80% obsolescent and the

connectivity of the schools to the Internet, which is the technological disposition of the Telecommunications Company of Cuba S.A. (ETECSA) to provide the service from the approved budget (Castillo, 2016).

The Cuban state works to ensure technologies and connectivity from schools to avoid inequalities in the development of the teaching-learning process mediated by ICT, since all students and teachers do not have Internet connection from their own electronic devices, because of their cost for the Cuban family.

These obstacles are part of the road that is being traveled to raise the quality of the educational system, which is one of the foundations of social work in the country. There are already more than 1,600 schools of the different types of education that have access to the Internet (Salazar, 2017).

The use of ICT has been considered as a guideline in the new curricular changes of the different educational systems, therefore, it is a mandatory requirement in the teaching-learning process of all disciplines.

Since the 1980s, an internal, stable and growing consumption of educational software has been developed in Cuba, since the creation of the first Educational Software Studies Centers by the Ministry of Education, in different pedagogical universities. For more than 15 years, these centers have developed the most important collections of educational software in the country, corresponding to each of the educational levels. Among them, Cesofted stood out in Havana City, Visofted in Villa Clara, Cejisoft in Camagüey, Cesoftad in Holguin and SoftEE in Granma province.

Such study centers worked collaboratively in the production of educational software collections and the Ministry of Education was responsible for distributing the tasks that corresponded to each center during the elaboration of the different collections. In this way, excellent collections of educational software were developed, such as „Multisaber" for Primary Education with a total of 32 software applications, „El Navegante" for Secondary Education with 16 software applications of different specializations and „Future" for Pre-university with 19 software applications (González del Toro, 2017).

Classified as a hyper learning environment, these software packages have had, over the years, a very favorable impact on ICT learning in Cuban education due to its multimedia, interactive nature, adaptability and attention to individual differences, orientation towards acquisition of knowledge, the development of skills and the formation of values. These have been updated and, almost 100% are online.

Researchers from different countries, in the field of pedagogy, have shown interest in its conception. Among its modules there is the one that is aimed at the didactic games, exercises, updated with topics, library, registration or trace of the student, methodological guidelines for use directed to the teacher.

With the development of software producing institutions and companies and the potential of human capital, many computer applications for learning have been added to existing software collections at different levels of education.

One of the most striking experiences in this regard is the Web portal Cubaeduca, which constitutes a virtual space, as an integrating platform, which serves as a gateway to a whole set of contents and services related to Cuban education. It is recognized as an interactive, systemic, dynamic communication channel that is committed to the curriculum of the Cuban school.

The universities, on the other hand, were the educational institutions prioritized when establishing connections to the Internet. Currently there is a policy of improvement in infrastructure and connection speed. That is why in June 2016 the Ministry of Higher Education of Cuba (MES) began to implement the new Distance Education Model (CENED, 2016) supported in ICT, taking into account the new technological scenarios and the experience of more than three decades of distance education, in more traditional ways. This is justified by reasons such as a slow population growth with a tendency to decrease the economically active population that prefers to combine study and work, the greater connection between universities and employing units and the needs of digital natives.

In general, in Cuba, the Moodle platform is used as Learning Management Systems, and in the last five years there has been an increase in offers of postgraduate, Master's and graduate courses, both by universities and other authorized institutions. In the undergraduate program, there is a strong tendency to use these platforms as support for face-to-face teaching.

It can be said that the country has just begun a new era in the production and commercialization of open and online digital content for national consumption and abroad, that is why the presence of MOOCs as a modality of Distance Education is just starting. As part of the insertion in these new modalities, several platforms have already been created for this purpose.

ICT for disadvantaged people in different countries and Universal Design of Instruction

We hold the criterion that when a country has a consolidated policy of social inclusion, this implies the need for digital inclusion as a citizen's right. However, there are limiting factors that influence, despite the established policies of social inclusion. In Cuba, the limitation of access to ICT is related to different factors:

- Physical and intellectual shortcomings of individuals for the use of ICT (disability).
- Shortcomings related to the generational age, in the case of the aged and elderly who have very low skills in the use of new technologies.
- Shortcomings deriving from residing in remote rural areas with few possibilities of accessing certain technological infrastructure created.
- High cost of mobile devices and Internet services despite the gradual trend to reduce this cost.

Digital inclusion of the disabled, then, has a basis of social inclusion. Complete social equality is endorsed in the current Constitution of the Republic of Cuba. One of the priorities of the Cuban social policy is the attention to people with disabilities. According to information from Radio Ciudad Habana (RCH, 2018), there is a *National Plan of Action for Children, Adolescents and their Families*. This plan is carried out by all the Associations and the Organisms of the Central State Administration, which are grouped, since 1996, in the National Council for Attention to Disabled People, known by the acronym CONAPED.

This action plan is a compendium of strategies, proposals and programs, constantly updated, whose main objective is to develop actions for both social inclusion and the improvement of the quality of life of these people. It conceives actions and services for the equalization of opportunities, integration, active participation in social life and the development of personal autonomy and independence as much as possible. This plan stimulates not only the development of scientific research, but the training of human resources linked to working with disabilities.

The National Plan of Action for Children, Adolescents and their Families, approved by the Cuban State for the period 2015-2020, is based on the principles of the best interests of children: equality, non-discrimination, rights guarantee and participation.

One of its main objectives is to guarantee the promotion, prevention and quality of care for children and adolescents with disabilities. This plan is articulated with the goals of the United Nations Development Assistance Framework in Cuba. According to Cuban studies carried out, the most frequent disabilities are the intellectual and physical-motor disabilities, followed by the multiple and autistic, visual and auditory spectrum disorders.

Disability is classified according to the criteria of the International Classification of the Functioning of Disability and Health (CIF) in addition to medical criteria. There is also a National Disability Statistical Information System that promotes knowledge and application of the CIF, which constitutes a technical instrument for research, the definition of social, clinical, epidemiological, educational policies, as well as in the field of statistics.

Data from CEPAL (2014) indicate that, at present, 362,222 people with disabilities are registered in Cuba.198,180 of them belong to the male sex, 164,042 to the female and 47,806 are under 19 years of age. These people have universal and free access to different support services, included in the field of health and education. They are guaranteed, for example, devices such as hearing aids, orthopedic prostheses, wheelchairs, canes, cochlear implants, among others. In addition, these people can participate in the Intellectual Disability Care Program that offers community and institutional care throughout the country.

The three non-governmental associations that bring people with disabilities together in Cuba: the National Association of the Blind and Visually Impaired (ANCI), created in 1975, the National Association of the Deaf of Cuba (ANSOC), founded in 1978, and the Cuban Association of Limited Physicists and Motors (ACLIFIM), constituted in

1980, participate actively in the political decision-making processes in their congresses, maximum organ of management of the Associations. They also participate in the social programs, where the main objective is the integration to the Cuban society with equal rights and duties, conditions and opportunities, accessibility to the physical, social, economic and cultural environment, health, education, information and communications, so that these people can fully enjoy all rights and fundamental freedom principles.

Cuba has ratified the Convention on the Rights of the Child that reaffirms the protection of children with disabilities, as does the Convention on the Rights of People with Disabilities. In order to promote the social inclusion of children with special educational needs, associated or not with disabilities, a universal National Education System has been designed, free and accessible to all Cubans, and counts, among the different types of education, with Special Teaching aimed at this segment of the population, which guarantees the exercise of the right to education and increases access opportunities.

The principle of universality that characterizes Cuban education makes it possible for educational centers to create conditions that favor inclusive processes in regular contexts and provide these students with reasonable adjustments in accordance with their needs and possibilities, all of which together between special education and the different educational levels of the Ministry of Education for the care of students with disabilities. Specialization courses are also developed for teachers of regular institutions, numerous supporting texts are produced, and even students without disabilities are trained in the knowledge of sign language, the Braille System, and other topics related to Guidance and Mobility.

Special school provide special teaching aids, specialized preparation and psychopedagogical guidance to students who receive educational attention in regular schools of the various levels.

The Ministry of Education (MINED) also has educational centers for the education of the deaf and teachers trained in the Cuban Sign Language, these centers are integrated into general education, upper secondary education, technical schools and Professionals, including Art and Plastic Arts Instructors Schools. Since the creation of the School for the Formation of Sign Language Interpreters in 2004, 7,000 interpreters have worked in the MINED and in the ANSOC offices.

In Cuba, special schools are not compulsory. They have a transitory character and are aimed at the formation of skills that allow learners to succeed in their insertion in regular schools. In them, the basic curriculum of general education is applied, with some curricular adaptations, fundamentally in those that need more intense supports. Both in these special and regular schools the use of ICT is part of the curriculum, so there is equipment to achieve the insertion of children and young people into ICT. Some special schools already have an internet connection.

Children with disabilities are cared for since early childhood in general programs designed for these ages, ensuring coverage of 99.7% of children population, including those in rural areas with the *Educate Your Child Program,* a modality of child care for

children who are not in educational institutions permanently. In this way, 5,361 children with disabilities are treated in the country.

The number of students who attend the institutions and modalities of special care today does not exceed 3% of those who attend regular institutions. The total of students with disabilities attended today in regular institutions amounts to 11,156.

Even those students who require more intensive support are served not only in our network of special schools, but through other channels and modalities of attention such as: regular schools, ambulatory care and, eventually, in hospital classrooms, but in all of these cases, the intention is to pursue the qualification and development of functional and social-work skills that allow children to perform fully in adulthood and prepare the family for accompaniment in this process. The most aggravating cases are attended in Psychopedagogical Centers, attached to the Ministry of Public Health.

Therefore, the preparation of disabled children in the use of ICT is done in special or regular schools with equal access to other children. In the case of disabled adults, they can access ICT through the Youth Computer Club, named after the 600 service centers for the Cuban family in terms of technology or in those cases inserted into different work activities.

It is worth noting that the work horizon opens with hopeful possibilities, since more than 20,000 people with disabilities are employed in formal jobs or in special workshops and many others do paid work at home, while those who cannot afford support for themselves are given financial aid and the corresponding health coverage. Approximately 1,400 people with disabilities access some type of employment every year and some of them find opportunities to access technologies in these jobs.

It is essential to train skills that facilitate their preparation for the changes in technological development that are constantly generated in the country, hence the teaching of computers from preschool and the use of new technologies play a fundamental role not only in rehabilitation, but in professional training.

Higher education in Cuba is also inclusive and every Cuban young man who meets the requirements to enter higher education, can enroll, receive adjustments in their training processes, if required, have technological means for their studies, be trained with quality as a professional and have assured a decent job, according to their qualification. Today there are 204 university students with disabilities distributed in universities throughout the country accessing ICT and the Internet from these institutions, with equal rights.

Karell, B. and Llópiz K. (2018) state that other measures have been taken with respect to communications. At the end of 2017, 47 low-level telephone booths were installed. The bonus of 750 minutes has been extended to residential services that benefited 13,347 people with disabilities, and 900 minutes to services of the Associations of people with disabilities, broken down into 113 in the ANCI headquarters, 83 in the ANSOC and 114 in the ACLIFIM. In 2017, 428 people with disabilities graduated from the courses taught in the Computer Clubs network, as well as HTML courses, Microcomputer

Operator, Microsoft Windows and Microsoft Word were developed at the headquarters of organizations of people with disabilities.

It is worth noting that ANCI is considered internationally as one of the most advanced blind associations and is an active member of the Latin American Blind Union (ULAC) and the World Blind Union (WBU). At present, there are more than 140 special workshops with blind and visually impaired workers in Cuba.

Access to culture is promoted through the distribution of literary works written in the Braille system and audiobooks, and computer labs are Retrieved from all municipalities to reproduce documents, do working time with computers and receive courses of computer operators.

The elderly constitutes another group that has been taken care of socially, which guarantees them access to certain conventional audiovisual or computer media. It is important to explain that one of the prioritized programs in the country is the attention given to the elderly due to the degree of aging that the Cuban population has.

At the opening of the XV International Longevity Seminar „Longevity 2018", held at the Havana Convention Center in April 2018 with a participation of more than 250 representatives from several countries, Dr. Alberto Fernández Seco, Head of the Department of Attention to the Elderly, Social Assistance and Mental Health of the Ministry of Public Health of Cuba, announced that 20.1% of the Cuban population is 60 years old or older and predicted that by 2020 it will be 21.5% and in 2030, 30.3%. These statistics place Cuba as the oldest country in Latin America. (ACN, 2018).

A report by Barbosa León (2016) states that demographers warn that Cuban population has reached its maximum volume of over 11 million inhabitants and, from then on, it will always be of negative growth. As many scholars of the subject have said, this phenomenon poses innumerable challenges for today's society when it is known that in just five decades the number of long-lived Cubans grew rapidly.

As part of the actions developed for the elderly, the country has developed several programs, among which are the Homes of the Elderly, which already amounts to 280, which are day-time institutions with a living conditions regime for the elderly without relatives who can take care of them during the day. They sleep in their homes, though. Another development program is the so-called Nursing Homes of internal regime and Cuba has 149 of these institutions with a capacity for 11,771 people. There are also 11 asylums sponsored by religious orders that also receive a state budget and supplies in medicine and food, for its normal functioning.

Together with these programs, the Homes for the Elderly were born at the end of the 80s with the purpose of dedicating several hours of the day to the realization of physical exercise in parks of towns. These groups also organize cultural and recreational activities for the enjoyment of their members.

Although no study of the elderly population with access to mobile devices, personal computers or Internet services has been published yet, interviews with staff working

in Homes for the Elderly reveal that elderly people are influenced by Information and Communication Technologies, first through radio and television programs. Another group of older adults in better economic, physical and mental conditions have mobile phones and state that they use them as a means of obtaining information, entertainment and communication with family and friends.

Cuban television has a variety of programs and spots where the issue of population aging is addressed. Also a series and novels that address the conflicts of the elderly is broadcasted.

The emergence of more than 600 Youth Computer and Electronics Clubs in each territory of the country, has been an opportunity for the elderly, women housewives and family in general to access new technologies.

The rural area in Cuba has had greater limitation in access to networks; however, many audiovisual media are used as a complement to the curriculum. Some children and young people in rural areas are gradually acquiring mobile devices depending on the possibilities of families, since the cost is still high. In the past year, the Youth Computer and Electronics Club began to carry out digital literacy actions in certain rural areas, focused on the management of mobile devices, with highly satisfactory results.

ICT in inclusion. Significant experiences in Cuba

In Cuba, significant experiences of digital inclusion have been obtained. One of the most important achievements in the country is the creation of the Youth Club of Computing and Electronics (JCCE) that constitutes a network of technological centers founded in September 1987 with the aim of socializing technologies and computerizing the whole society. Today they reach the figure of 600 in the country.

The scope of action of these centers make them perform an essential task in the integration of ICT to community life, that is why they are promoted as „the computer of the Cuban family."

These centers offer training and certification services in ICT, development of computer applications, audiovisual productions, advice on the implementation of technologies, network management, educational and recreational games, navigation through the Cuba Network and access to digital libraries, as well as services of video calls and device rentals.

More and more people attend these centers every year: children, young people, the elderly, housewives, self-employed workers, students, the disabled and the general public. Also companies are attended and collaboration agreements and strategic alliances with society's institutions have been made. In the same way, some successful experiences have taken place with the population of rural areas.

Today all the facilities have specialized workers that are around 5,000. 47 % of them are university students, more than 1,500 are fluent in a second language and there are also 800 who hold Mater's degrees.

With this trained staff it has been possible to expand the services and courses. In addition to basic, specialized and postgraduate training, there are courses for children, others for the disabled and seniors. During these 30 years, computer applications have been developed, given assistance and advice, and more than 4,550,000 people have graduated (Martínez García, 2017).

Training in topics related to information technology, communications and electronics is a fundamental pillar of the work carried out by these facilities. The courses of topics related to the ICT that are offered generally have a duration between 20 and 120 hours with their consequent certification.

The possibilities of managing information and knowledge are articulated in the Youth Club in different ways, the Information Centers with a wide range of services, the Digital Libraries, the Software Banks, the spaces for reflection and exchange, among many other modalities.

Similarly, these centers develop social activity in the community, as is the case of computer contests, historical, festivals of recreational, cultural, didactic, service; the digital sports championships, videogame tournaments, the clubs, gatherings, among others. Even when the social success of a project like "Joven Club" is demonstrated in the interest of Cubans, maintaining these services is expensive for the country, which is why since 2014, a subsidized fee has been decided for some services.

The collaborative encyclopedia ECURED, installed in all the educational centers of the country and visible on the Internet, is one of the products produced by Joven Club, that have had greater acceptance in the country and in the Cuban family. The Cuban encyclopedia provides universal knowledge to most Cubans. It is notable for its breadth of content about Cuba, its history, culture, personalities and scientific results. According to its general director, Ecured has more than 532 active collaborators and more than 39 thousand registered and it receives visits from different Latin American countries such as Mexico, Ecuador, Guatemala, Colombia, Chile, Venezuela and others. According to the registration of visits, it is consulted daily by more than 250,000 people (Torres González, 2018).

One of the products with the greatest impact on the Cuban family that markets the young clubs internally is "La Mochila", which is simply a digital package at low prices that is distributed throughout the territories by this institution. It is a Cuban cultural project launched in December 2017, considered as a non-traditional television channel.

This product allows each user to create their own programming within the materials provided for the entertainment of all ages. The objective of its creation is to be able to provide the Cuban public with national and international material, so that this new recreation alternative is available to all. Therefore, this variety of contents is disclosed weekly for the different tastes and interests of the user. Its distribution is made under the principle of reaching each home and that the Cuban family can consume it at the time they prefer.

Another of the products in great demand, produced by these centers is "La Tendedera", which is a social network of the Cuban family designed to be accessed from the

Joven Club, "Cursad", a platform that offers distance and online courses, "Reflejos", which constitutes a platform for blogs, "Ludox", portal dedicated to video games and "Estanquillo", a platform for digital magazines.

Among the experiences obtained, is the pilot test conducted in a rural area of Santiago de Cuba, specifically in the town of Caney, the purpose was for the population to learn to use technological devices such as cell phones, tablets and computers. According to María de los Ángeles Pérez Ramírez, deputy general director of Joven Club, the families of the area offered their houses and computers to teach the course, which made the experience much more enriching.

As a result, 68 instructors from this province were trained and the Ministry of Education, Public Health, INDER and the Ministry of Culture were linked. In a week, 48,651 people were able to read and write, including 120,000 children, 419 elderly people, 88 disabled people and 19 young people from prisons. The project is becoming widespread in other rural areas of the country.

Another of the experiences for digital inclusion, is the annual INFOCLUB event developed by these institutions where presentations are presented with work experiences with the most complex groups to access ICT, such as the elderly, women from rural areas, disabled, family and community.

On the other hand, Cuba shows numerous specific experiences with the digital inclusion of the disabled. It is necessary to highlight the active participation of people with disabilities in the dissemination and awareness of their rights using audiovisual media. In the different associations of the disabled in the country there are 377 volunteer correspondents who are in connection to the different media, directed by the Cuban Institute of Radio and Television (ICRT). Likewise, the Closed Caption system for subtitling programs remains stable in all national television channels.

Another initiative has been the call for competitions that bring together people with disabilities of all ages and public institutions related to the rights of these people. Audiovisual works have been developed to reflect the way of life of people with disabilities and their individual development in the different spheres of social life.

The Ministry of Culture has worked to ensure the inclusion of amateur talent of this population group in the cultural programming of the territories. With this purpose, the work of art instructors has been strengthened to stimulate the design, execution and systematic evaluation of socio-cultural actions and projects aimed at people with disabilities, especially children and adolescents. According to Karell and Llópiz (2018), among the main socio-cultural projects in the country are: *Count on me, With love and hope, Joys in the heart, Happy little farm, Without limits* and *Petals of love.*

Another project related to raising awareness is *Touching the Light*, by the Cuban Institute of Arts and Cinematographic Industries (ICAIC) and the ANCI. It consists of the incorporation of the Audio-Description system to 98 Cuban titles. It has fostered socialization and cooperation with people with visual disabilities and their families. About

5,500 spectators have enjoyed and attended this service. There are subsidiaries of this project in rural areas of the country.

The *Doves Project*, whose work focuses on the promotion and integration of people suffering from social exclusion, has made audiovisuals related to people with disabilities. For example, *Thanks to life, My body on the road, Way between my dreams, Different times ... in time, A woman ... with a city inside*. These works address the desires, aspirations, life stories and personal growth achieved by people with disabilities in different areas.

Similarly, the National Council of Plastic Arts conducts workshops and other projects in coordination with plastic artists in several provinces, to which they incorporate people with disabilities. Thus, the *Imagining United* project is developed with the participation of autistic children and Down syndromes, the project *The Yeti* groups students with autism, schizophrenia and physical-motor disabilities, among others.

The Cuban Radio designed a Communication Plan for the timely treatment of the topic, appropriate to the profile and style of each station, for both the traditional platform and the Internet.

Comprehensive and technical training courses have been given to personnel who directly assist people with disabilities in public transport terminals and stations aimed at assimilating new technologies. In 2017, the airport traffic courses incorporated the participation of the ANCI. The proposal of the instruction program linked to persons with disabilities of the Air Transport Facilitation Course was approved, and it began to be taught by the Aeronautical Training Center.

Due to the relevance of the results, it is necessary to refer to the Cuban experience in the use of ICT with schoolchildren who are blind or who have mental disabilities. In this sense, important results have been obtained in Cuba by teachers of Higher Education.

Thus, works such as; *Methodological conception for the use of computer science in the teaching-learning process of school children with mental disabilities*, thesis presented as an option to the academic degree of Master in Educational Sciences of Fernández, I. (2005) and a *Psychopedagogical Program for learning of the computer literacy skills of blind schoolchildren in the first grade*, which resulted from the doctoral thesis of González Peña (2009).

This last work has had a significant impact, based on the researcher's own experience as a blind person, who has dabbled in how to teach blind schoolchildren the use of ICT. This researcher is part of the faculty of our university and managed to implement a project with the use of a methodology that he implemented in the school „Fructuoso Rodríguez" in the city of Santa Clara, Cuba.

This research went through the development, application and evaluation of a psychopedagogical program that is structured in five areas. In order to design this program, he carried out an initial theoretical study, which allowed to systematize the main conceptions about the efficient insertion of computer science in the education of blind schoolchildren.

This researcher found a relationship of dependence between the expertise achieved by blind schoolchildren of computer tools and the development of particular skills, to these skills he called basic computer skills.

González (2009) points out the importance of approaching from the teaching-learning process the development of 4 skills of this type.

- Skill for orientation in the computing environment.
- Skill to detect signals coming from the computer.
- Skill for listening comprehension of synthetic voices generated by software readers and screen descriptors.
- Skill for dynamic coordination in keyboard manipulation.

The methodology created by this researcher is structured in five basic areas and was implemented through a postgraduate course.

Area I: Teaching staff preparation: This area is distinguished by the fact that it begins with a diagnosis of the competences that teachers present to promote computer learning for blind schoolchildren. In this regard, a survey, an interview and the content analysis of official documents such as: programs and methodological guidelines were carried out.

Area II: Diagnostic battery: The diagnostic battery offers a set of tasks that allow the teacher to characterize the level of development of those sensory systems that are conserved in children and that with high incidence are used in the management of computers (ear and tact), the spatial orientation and the manual dynamic coordination, as well as the motivations they have towards the learning and use of the computer science by the blind schoolchildren who attend the first grade.

Area III: Didactic Recommendations: Under this area, a group of recommendations are offered aimed at guiding the teachers to carry out precise actions allowing blind schoolchildren to be able to appropriate the basic computer skills needed to operate computers efficiently, transferring what has been learned to solve academic problems and problems of daily life.

Area IV: Actions of family orientation: Within the psychopedagogical program, the area of family orientation is eminently educational, since it is aimed at preparing the family so that, in a coherent, systematic, and based on a close link with the teaching staff, this area can help with the computer education of their children.

Area V: Evaluation of the psychopedagogical program: The evaluation of the psychopedagogical program was conceived through the application of a set of instruments, among which we can point out: a pedagogical test, a questionnaire to teachers and direct observation of different types of activities (curricular, extracurricular, and extra scholar).

As can be seen, in terms of politics and ICT teaching, our country has provided valuable experiences; however, the economic blockade of the United States to Cuba, which is trying to economically suffocate the country, has constituted a barrier in the rapid

development of ICT, in many educational institutions there is obsolescence of equipment that need renewal and despite the efforts of the state, access to the Internet has a high cost to the population.

However, according to data published in the television network La Mesa Redonda, broadcast in December 2018, this digital divide is dramatically reduced in the last three years, following an investment process by ETECSA (Empresa de Telecomunicaciones SA and the achievement of the Program of Computerization of Cuba foreseen up to the year 2030.

Challenges and technological innovation in Cuban education

Cuba has a recognized prestige in the world in the field of Pedagogy and Didactics. Although in Cuba online learning still has a long way to go, teachers have a deep interest in knowing many learning techniques that have emerged associated with the development of the internet. Such is the case of digital stories, the inverted classroom, or work with open educational resources.

One of these techniques that have been used in Cuba is the storytelling. The oral tradition and the art of storytelling is as old as the human being itself (Temporelli, 2014). The ancient cave paintings are considered a form of narration for many ancient cultures (Castillo & Martí, 2006). Oral narration is not a simple repetition of texts, it is described as „an art in itself" (Navarro, 1999, p. 29), „an act of communication" (Garzón, 1991, p. 13)," is to offer to those who listen to us the full history of life again „(Garcini, 1967, p. 43). In short, numerous authors in Cuba and in the world characterize the oral narrative from different angles, but with coincidences in several aspects. Oral narration is a precursor of the new trend in the information and communication society, or digital storytelling.

Searching in Google Scholar, there are no references found of Cuban authors who have worked digital storytelling, although there is a long tradition in terms of oral narration and their work in preschool and primary education. On the other hand, this content is part of the curricula for the training of teachers.

Infographics is an approach to digital narration. Infographics is understood as information in graphic format. With the irruption of ICT (Information and Communication Technologies) in the teaching-learning process, the digital infographic variant emerges, characterized by the integration of several digital resources for the presentation of the contents by the teacher or to present results of the work of students.

In Cuba, there have been some experiences in this regard, such as:

- The design of a digital infographic system for teaching a subject (Ortiz, 2018).
- Establishment of a conceptual theoretical framework on the existing dilemma between the categories of infographics / iconic text (López, Reine, & Rubio, 2018).
- The use of computer graphics in the training of computer engineers (Borroto, 2016).

An approach to digital storytelling in teacher training

In the Central University „Marta Abreu" of Las Villas, the specialties of Primary Education, Preschool Education and Logopedia are studied and include Educative Informatics as a subject. In its contents, there is a unit devoted to Educational Software.

Since the 2016-2017 academic year, a similar experience including digital storytelling has been developed, aspects of which are described below.

A similar experience to digital storytelling was worked on with a project approach, in the subject Educative Informatics, specifically in the topic "Advanced Options of Power Point for the development of computer teaching media".

Initially, theoretical foundations related to educational software and the different typologies in which they are classified, are taught. And the contents related to the potential of the Power Point for the elaboration of educational applications are subsequently taught.

In the case of Logopedia, students are given the task of completing a multimedia program in order to enrich their logopedic classes, here they must:

- Carry out the logopedic diagnosis of the students with whom he works, the contents of the subjects they receive and the applications available for their integral logopedic attention.
- Prepare a story, real or fictional, related to a study topic
- Tell the story in a simple and fun way
    - Carry out the work collaboratively with the students of their workgroup
    - Include images, videos or audios, according to their possibilities.
    - Each student must specify the following requirements:
    - Objective of the multimedia.
    - - Design and navigation (you can describe it and accompany it with schemes)
      - Methodological guidelines for the speech therapist.

As a result of the students' work, in the 2016-2017 academic year, applications were made whose names and objectives are listed below:

- Visuallog: To contribute to the process of visual stimulation of children with low vision that also manifest disorders in pronunciation.
- Reino animal: To stimulate the development of oral language in a 1st grade school with difficulties in the grammatical structure.
- Cuentos infantiles para educar: To contribute to the expansion and development of the vocabulary of children with primary language delay, who are studying the fourth grade.
- Mi Aventura durante el día y la noche: To stimulate the development of the temporary orientation in children who present a speech level special need: functional dyslalia, and who attend the preschool level.

- Aprende los siete dias de la semana: To expand the vocabulary of a second grade school scholar my means of a diagnosis on secondary language delay through the learning of the days of the week.
- Jugando aprendo: To stimulate the phonological phonetic component of 1st grade students by means of a diagnosis on secondary delay of language associated with intellectual disability (RM).
- A conocer los animales: To encourage the development of oral language in children with intellectual disabilities, promoting phonological development and grammatical lexical enrichment, using varied and enjoyable activities that awaken the interest and motivation of students.
- Para aprender más: To contribute to the prevention of motor dysgraphia in 2nd grade students.

In the case of Primary Education and Early Childhood Education, requirements similar to the previous case are included, such as:

- The diagnosis of the schoolchildren or the children of early childhood and the software Retrieved from the children's daycare center and in primary school.
- Elaborate the narration about the classic stories of universal literature, such as Snow White and the 7 Dwarfs, Sleeping Beauty, Cinderella, among others, although you can also choose other less known stories of Cuban or universal literature, or a story related to a study content in the grade in which you work.
- Tell the story with your words in a simple and fun way.
- The narration of the story in the voice of the student.
- Carry out the work collaboratively among the students of the team.
- Include images, videos or audios, according to your possibilities.
- To deal with values that are present in the narrated story.

Although the experiences presented do not exactly constitute the implementation of digital storytelling it contains several common aspects such as the student's realization of a digital application to tell a story in a creative, collaborative, motivating and meaningful way.

On the other hand, the authors of the present paper believe that this experience prepares future teachers to incorporate digital storytelling in their daily work.

Regarding the use or implementation of the blockchain and global pedagogy to share, no work by Cuban authors in this sense is referenced.

Commercial aspect of ICT in education and inclusion in Cuba

Despite the high scientific potential that has been formed in Cuban universities in the area of technology, the economic difficulties experienced by the country, especially the blockade, the country has not yet been able to consolidate itself in the international market and, as a consequence, a stage of development of the Cuban software industry is

just beginning, not only for commercial purposes, but as a productive force for updating its economic model.

These economic limitations have impacted the problems of internet connectivity over the years and it is from now on that these services are being expanded with the gradual acquisition of the infrastructure that has a high cost for Cuba. In this way, the educational software that was produced was destined to an internal market because we did not have a consolidated software industry as opposed to the scientific potential.

However, the market for educational software in Cuba, is being developed step by step and its development is explicit in the Integral Policy for the Improvement of Computerization in Cuba (MICOM, 2017), a program of the Ministry of Communications that is part of the National Development Plan Project Economic and Social of Cuba until 2030.

Since the 1980s, the educational software that produced the MINED (Ministry of Education) with its large collections for different educational levels, was directed towards an internal market. Therefore, these products did not have marketable purposes abroad, but meet the demands of the curriculum as a complement to the school curriculum marketing only in Latin American countries under certain collaboration agreements.

It was not until April 2015, that the Informatics and Audiovisual Media Company (CINESOFT) was created as the institution that belongs to the Ministry of Education of Cuba. It is specialized in the production and commercialization of educational software, that responds to the demands of the country to consolidate a Cuban industry of the software given its high scientific potential in the area of technologies and pedagogy (González del Toro, 2017).

Its production lines continue to be, in the first place, depending on the internal market, especially the national education system, and everything that is designed is integrated into an audiovisual and computer platform called CUBAEDUCA, where repositories of resources can be found. The repositories fully cover the contents curricula of all levels of education, resources for teachers, advice for the family, among many projects, and lines of services. They also provide node management services, data networks, repair and maintenance of computer, audiovisual and teaching equipment.

CINESOFT increasingly expands its field and is oriented towards the entertainment industry with the development of video games, the knowledge of values and national culture with the creation of virtual visits to museums, audiovisual productions of topics of interest and advertising spots.

Another of the lines with which this company works is the positioning of videos on the Web. For this purpose WebTV has been created. It generates audiovisual resources with more dynamic codes and different formats to complement the information of the CUBAEDUCA portal. The production of documentaries and the creation of programs for national television is another of the areas that it develops.

In order to become strong in the foreign market, it participates in projects with Ministries, Colleges and Universities of Colombia, Mexico, Venezuela and Guatemala,

focusing its efforts on conquering the attention of the public and private sectors of this geographical area. It works intensely in converting the created collections to free software and it is currently transferring these collections to operating systems to be used in tablets and cell phones.

According to González del Toro (2017) CINESOF is becoming a company with high added value. At the end of 2017 they obtained nearly nine million pesos sold. Its director, Dr. C. Iván Barreto, explained that the company today owns almost 40% of profits, a clean profit for the national economy. In addition, the average wage of workers has been raised, based on their profitability. Due to the importance given by CINESOFT to teaching, work is being done on the creation of a regional center for the generation of educational resources for Latin America and the Caribbean, with the intention of sharing the pedagogical and technological models Retrieved from Cuba, which guarantee training suitable for children and adolescents.

Another Cuban company that has oriented part of its commercial activity towards educational software is CITMATEL, according to reports from the CUBADEBATE website (2018). This entity has been created for 17 years and has operated, in general, in the field of information and communication technologies, through an integrated management system of quality, environment, safety and health.

In the field of educational software, this company has created multimedia, thematic series for the learning of Physics, Mathematics, Chemistry, Spanish, IT and languages. It has produced materials for Film and Television that are very popular with children, young people and the general public. Its products have export as a fundamental destination, although they are also sold in the domestic market, especially for tourism or promotional activities.

The development of Internet platforms is one of the lines developed by this company, including those aimed at e-commerce and those related to distance education. As part of the latter, is coursesinlineacuba.cu, which teaches courses of more than 30 different topics in collaboration with prestigious Cuban institutions.

CITMATEL also develops in the production and marketing of electronic books, audio books, audiovisuals, applications for smartphones and to achieve greater visibility of these products, the platform was created (libreriavirtual.cu), which allows access to content of various formats.

There are other companies and software development groups that have had some results in educational software, but they have a wide range of services, beyond the educational sphere. This means that they are not specialized companies in educational software, but that in one way or another, they have managed to solve specific problems in education or also management and market.

An example of this are the 14 centers of development and innovation that have been created at the University of Computer Sciences (UCI). This university has gone from a scheme of training professionals to a scheme of training, development and innovation

and, with this, it is expanding its range of impact in the different sectors of society and for export (Alonso, 2017).

In recent years, the institution has worked on around one hundred development and service projects, all designed under a market strategy that allows gaining visibility in identifying the institution in the world.

Especially in the sphere of education, it has stood out for the production of video games that transmit values in alliance with the Cuban Film and Television Institute (ICAIC) and the creation of platforms for on-line courses such as CAEL and RedUniv.

Multiple companies have relied on the UCI to solve problems associated with the technologies, expanding their internal and external markets. They constitute the leaders in the migration of the country to Open Source and Free Software technologies, from the development of Nova, the Cuban distribution of GNU / Linux.

The UCI obtained in 2015 the international certification Integration of Capability Maturity Models (CMMI, initials in English) for its production processes oriented to various sectors of the economy and services within and outside Cuba (Falcón, 2015). Thus, it became the first Cuban institution to receive this international certification that opens the way for the software industry in the competitive commercial world.

Martínez (2017) expresses that the Youth Computing and Electronics Club, have an impact on the internal software market, although they have not been designed to export computer products or services. This is due to the fact that they offer services at a reasonable price to reach the sectors of the population. Its fundamental role is not marketing; however, services are commercialized, and its own and third-party products are distributed. There are companies like Desoft which although they do not specialize in educational software, they contribute to the education of the population. Desoft has updated the business model to project itself in the market from the perspective of the commercialization of software as a service. The company covers the complete development, sales and after-sales cycle for IT products and services (Cubadebate, 2018).

An example of this is the project being in execution with the Cuban Institute of Radio and Television (ICRT) in relation to digital television in order to offer better programming and transport, a messaging system that is used in numerous social activities such as press headlines, billboards and participatory events.

The creation of AVANTE (Business Agency of the Ministry of Information Technology and Communications), also opens the doors to Cuba to the market (Menéndez, 2009). This company operates through collaboration agreements and facilitates market research, intelligence and management services, trends and market integration. It carries in its business portfolio all the products, whether they belong to the Ministry of Communications or not, and works non-profit for all the companies producing and marketing software in the country. Despite its short working time, that entity specializing in information and communication technologies has established relationships and obtained business results in more than a dozen countries.

Another of the ways used for selling educational software, is the Technology Fairs, an example of which is the Feria Internacional Informática Habana, which takes place every two years. In the last one, carried out in March 2018, 24 projects were presented developed by governmental companies and the non-governmental sector with a view to their export (Telecubanacán, 2018).

Similarly, Cuba is inserting itself in international fairs in other countries where it promotes its products. An example of this is the participation of the Cuban company DESOFT in Indiasoft 2019 that took place in the Indian city of Hyderabad, in the southern state of Telangana. According to Fernández L.G. (2019) these fairs help to know and achieve the establishment of alliances with foreign firms to address foreign markets.

Another important step taken by the country was the creation of the Union of Informatics of Cuba (UIC), born to group ICT professionals, belonging to the state sector or self-employed, this is considered a force that will enforce the development of the Cuban software industry to be able to insert itself in a very competitive market (MICOM, 2019).

Even when the foreign trade of educational software has just begun, Cuba has a highly qualified work force that, together with the implementation of the computerization policy of Cuban society, is already opening the doors to the development of the Cuban software industry and to the positioning of the country in the foreign market.

National recommendations for the SELI project

Currently Cuba is immersed in a process of computerization of society, among its main challenges is the integration of ICTs in all social sectors and the State draws policies and invests in infrastructure, so that technologies constitute productive forces in the update of the economic model.

Many are the limitations in the economic order, and to a great extent they are consequences of the strong blockade to which the country has been subjected; however, the high scientific potential in their human resources are exhibited as achievements. In these harsh conditions, the country advances in terms of technologies, and strives to reduce the digital divide, increases access to the Internet, increases mobile telephony and Wi-Fi points, for access to the network of networks and starts an ambitious program for the development of digital television.

Education benefits from this gradual development of technologies and among the main challenges of Cuban educational policy, is digital inclusion as an essential and humanistic component of this policy.

There are rich experiences in the use of technologies for working with digital inclusion, however, Cuba needs to assimilate advanced experiences that facilitate the path for the gradual transformation of learning models mediated by ICTs and this is where work in projects constitutes an important driving force.

Belonging to the SELI project, is an opportunity for Cuba because it is a means to get novel experiences from those countries that have already traveled a road with Internet work for the improvement of inclusive education. An example of this is the use of open access platforms so that disabled people, children and teachers of rural schools, the elderly or housewives, can solve problems of different nature with technologies which consolidate citizen participation in the country.

On the other hand, the digital literacy of teachers and teachers in training, will receive a strong impetus with the solutions proposed in the SELI project and this has to translate into a renewal of the didactics and a refinement of the current Cuban educational system. Among the main impacts that Cuba will receive from the SELI project, is the possibility of diagnosing the state in which the country is in knowledge and skills about open learning. It will also allow for the assimilation of the most current educational trends with the use of ICTs, as in the case of Flipped Learning, Storytelling, the use of blockchain and the introduction of teachers in the practice of a global and shared pedagogy.

The plan of action coordinated and staged by the SELI project will allow the expansion of collaborative relationships and solve pressing problems in the regional education of Latin America and of European Union countries and mobilize forces for collective solutions of educational problems of digital inclusion that are prioritized objectives of the participating countries.

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ICT IN EDUCATION: THE SITUATION OF DOMINICAN REPUBLIC

Abstract: The Information and Communication Technologies (ICT) development is vital for the progress of education in contemporary societies. Furthermore, the strategic use of different tools that ICT brings is necessary to reduce the high rate of vulnerable and excluded people in societies, especially in developing countries. In the case of the Dominican Republic (DR), since the end of the 20th century, the Government is investing on ICT development through different projects and programs, but one of the biggest and more extensive was launched in 2016, which is "República Digital" [Digital Republic]. This program and others have been the drive to improve the DR position regarding the use of ICT in the Region. In this chapter, you will find information related to ICT in education and inclusion in the DR, the challenges in the use of new technologies such as blockchain, global sharing pedagogy, storytelling and some recommendations for the SELI Project.

Keywords: ICT, Dominican Republic, Digital Republic, Innovation

Introduction

Since the end of the 20th century, humanity has been under the influence of a phenomenon that we have called „globalization", which has associated changes in the different spheres of society, both economically, politically and culturally. In this new social

model, information has taken a primordial place, and not being people able to access it, they get excluded, according to Castells (2006): „Globalization moves forward selectively, including and excluding segments of economies and societies from inside and outside of the networks of information, wealth and power that characterize the new dominant system „(Castells, 2006). This division is marked between those who have been able to master the access to the Media and the New Information Technologies and those who have been excluded and impoverished, those who are located metaphorically in"... the black holes of informational capitalism" (Castells, 2006).

A change begins in the traditional concept of regional development focused on satisfying the basic needs of the majority of the population of a certain area. The frontiers disappear before the new commercial and political relations between the countries, all of which have not necessarily brought a balance between the different human groups. It has begun to draw a new type of colonization in which we find two blocks (Martínez, 2005):

- A first block, developed, with intense and massive use of the New Technologies of Communication, and which allows a greater presence and further development.
- A second block, which is only possible for the restricted use of technologies, and more than emitters in exchanges, they can only remain as receivers.

The difference between the blocks leads us to what many authors have called „digital divide", a gap that has been widened over time, and encompassing not only states and ethnic groups, but also exists within the same human group where we find difficulties for equal access to technologies.

In this new context, the Dominican Republic begins a process of introducing ICT to the teaching-learning process, which is detailed in the following sub-chapters.

Presence of ICT in the Dominican Republic Context.

According to the National Statistics Office (ONE, 2018) among the population from 5 years of age and over, 40.1% used computers, 67.8% used Internet services and 85.8% used cell phone.

Table 1. Percentage of the population aged 5 years and over, by computer, Internet and cell phone use in the last three months prior to the survey, according to geographical, demographic and socioeconomic characteristics, (ENHOGAR, 2017)

Geographical, demographic and socioeconomic characteristics	Number of people aged 5 and over	Percentage of the population aged 5 years and over		
		Use Computer	Use Internet	Use Cell Phone
Total	**109,010**	**40.1**	**67.6**	**85.8**
Area of residence				
Urban	88,045	43.8	71	86.9
Rural	20,965	24.2	53.1	80.9
Geographic stratum				
City of Santo Domingo*	36,596	49.5	73.5	86.7
Big cities	20,529	47.2	77.6	90.6
Urban rest	30,919	35	63.8	84.7
Rural	20,965	24.2	53.1	80.9
Sex				
Men	53,448	39.3	67.3	85.7
Women	55,558	40.8	67.8	85.8
Age groups				
5-9	9,851	27.3	40.9	51.3
10-14	10,170	52.8	69.3	71.7
15-24	22,812	60	88.2	92.5
25-44	33,989	45	82.5	95.6
45-64	22,597	24.9	55.6	91
65 and over	9,590	10.2	19.5	72.8
10 and more years	99,159	41.3	70.2	89.2
Socioeconomic group family				
Very low	16,247	18	42.6	75.6
Low	21,578	27.5	58.1	83.6
Medium low	25,684	38.5	69.2	86.8
Medium and medium high	33,052	48.8	77	88.2
High	12,449	70.6	88.3	94.1

*Includes National District and urban area of the province of Santo Domingo, except the municipalities of Boca Chica and San Antonio de Guerra.

Source: Modified from ENHOGAR, 2017

With Decree 258-16, the Executive Power of the DR creates the "República Digital" [Digital Republic] program to meet the objective 3.3.5 of the National Development Strategy (NDT) „Achieve universal access and productive use of information and communication technologies (ICT) „so they are tools" enabling economic and social development „and are essential to achieve the goals of the 2030 agenda of the END (National Strategies of Development).

This „República Digital" program is based on „four fundamental components: I) Education, II) Access, III) Productivity and employment, IV) Government, digital and transparent; as well as two (2) transversal axes: Cybersecurity and Social Inclusion" and one of the purposes of the program related to ICTs and education and inclusion is „Design and promote inclusive strategies that incorporate technologies into teaching-learning processes in all educational subsystems" (Presidencia de la República Dominicana, 2016).

Within the *Digital Republic program*, in the Community Technology Centers (CTC), three citizen technology-training projects are being developed: Women in ICT, Native Digital and T-Includes.

The Women in ICT program seeks gender mainstreaming in technology issues for adolescents and young people from 12 to 35 years old; The Digital Native focuses on educating children under 12 years of age belonging to the most vulnerable sectors in TICs and is focused on giving participation and inclusion to the most vulnerable population, such as the elderly, young people with scarce resources and the disabled in ICTs.

According to the National Statistics Office (2018), the Ministry of Education (MINERD) has promoted initiatives to ensure the inclusion of young people and adults by 2020 and to increase the number of scholarships on ICT, and thus meet some of the goals of Sustainable Development Goal (SDG) of 2030 agenda. Among the initiatives are: Compu-Maestro 2.0 Program, structuring of ICT Clubs, computer equipment in libraries, technological corners in the initial level, mobile applications to learn and teach with ICT, Quisqueya in TIC, Virtual Classrooms (AVES), Digital slate for centers of excellence, Educational robotics, Multimedia integration program (PIM-Aprende), among others.

The National Institute of Public Administration (INAP), since 2018 offers from its website https://inapvirtual.edu.do/pdi/ free MOOCs courses aimed at public servants and to the general audience. Some of these courses are taught in collaboration with the Inter-American Development Bank (IDB).

Presence of ICT in the legislation of the Dominican Educational System

The General Law of Education 66-97, as well as the "Plan Decenal de Educación 2008-2018" (*Ten-Year Education Plan 2008-2018*), establish, in different articles, the interest of encouraging and promoting scientific, technological and humanistic knowledge, developing technological innovation and contributing the integration of ICTs into the educational processes. The following articles constitute the legal support of the integration of ICT in the education system of the Dominican Republic.

General Law of Education 66-97 Art. 99.-

The functions of the Ministry for Education and Culture, as regards scientific and technological education, include the promotion of the development of technological innovation in the education system, as means for achieving greater efficiency and supporting the modernization of the country, as well as fostering a culture of adoption of the changes coming from scientific and technological development.

Policy No. 3 of the Ten-Year Education Plan 2008 - 2018

The Ten-Year Education Plan 2008-2018 highlights the importance of the integration of ICT to strengthen the teaching-learning processes from the basic education level. In policy No.3 of this plan, the following is established:

„Periodically review, disseminate and apply the curriculum, guaranteeing reading comprehension and mathematical-logical development at the basic level and promote a culture of compliance from a perspective of education values that guide integral human development; consolidating all other dimensions of science at educational levels, as well

as the integration of Information and Communication Technologies into educational processes „(Ministry of Education, 2008).

Presence of ICT in Education: Background

In the period 1996-2000, the Ministry of Education (MINERD), formerly the State Secretariat of Education and Culture, develops the first national strategy for incorporating ICT in educational centers of the Middle Level, with the implementation of the Program of Computer Education (PIE), which included the installation of 324 computer labs.

In October of 1998, with the Departmental Order No. 6-98, the Ministry Education and Culture created the Department of Educational Informatics. Then, through the Departmental Order No. 008-2005, the Department of Educational Information Technology (DIE) rises to the General Directorate of Educational Information Technology (DGIE).

In 1999, the VSAT project was launched to provide internet connectivity by parable to all educational centers with ICT infrastructure, some 311 in total.

In 2000, five videoconference rooms were installed in the „Instituto Superior de Formación Docente Salomé Ureña [Salomé Ureña Teacher Training Institute (ISFODOSU)] premises and the technological infrastructure in these areas was consolidated with laboratories, laptop carts, video projectors and Plasma TV in their classrooms. Different Institutions of Higher Education (PUCMM, INTEC, APEC, UNIBE, etc.) installed their videoconference rooms and created their virtual campuses.

Since 2004, through the General Directorate of Educational Informatics, MINERD has developed a series of innovative initiatives and projects, such as: Technological Corners for the Initial Level, Laptops of Laptops, Digital Slates, Kit Multimedia (Plasma TV + Laptop + Digital Resources Collection), National Training Network on ICT skills, the 12 Self-sustainability Plan and Community Integration of ICT centers, the EDUCANDO educational portal, among others.

Similarly, the National Program of Computers for Teachers (COMPUMAESTRO 2004) was implemented, through which 22 thousand teachers benefited from a technological package that included computer + educational software + ICT training, financed at low interest and long term through credit institutions, with the support of MINERD, which, in addition, granted a bonus of 5 thousand pesos to each beneficiary teacher.

Throughout this process, more than 50,000 teachers, as well as district and regional technicians, have received some type of training in the use and integration of ICT in education.

In the year 2000, the Community Technology Centers (CTC) emerged, known as Small Intelligent Communities or LINCOS, installed in vulnerable areas of the country. In the beginning, they offered the following services:

- Information Services: Access to the Internet and databases.
- Telecommunications Services: Telephony, fax, and email.
- Information Processing: Texts, professional programs, and assistance for publications.

- Training on the use of the facilities of the centers and access to educational programs through the network.
- Job Opportunities: Access to employment information sources.
- Transactions of purchase and sale of goods and access to electronic commerce portals.
- Government transactions such as obtaining information or paying taxes.
- Different transactions for the preparation in some cases or replacement in others, of travel by procedures to the cities or nearby municipalities.

Presence of ICT in Education: Current Status

In the following lines, we present the technological infrastructure and connectivity of the Educational System of the Dominican Republic:

- 1,275 educational centers with some type of facility to use ICT as a resource for teaching.
- 4,364 centers with information technology to support educational management.
- An approximate enrollment of 800,000 students potentially benefited with technological resources to support their learning.
- ICT Infrastructure of 9,011 desktop computers and 3,721 laptops to support teaching and learning processes.
- 829 centers for teaching with Internet connectivity.
- 3,797 educational centers connected through broadband devices to support management.
- 1,565 interventions with ICT in educational centers (laboratories, laptop carts, technological corners, digital whiteboards, plasma TV).

Through the Department of Educational Computing, the following elements have been implemented by applying ICT in the school setting:

- National Training Program for the Integration of ICT in the Initial, Basic and Middle Levels; the primary objective is to train Managers and Teachers of the Initial / Basic / Middle Levels in Information and Communication Technology Centers in the use of ICTs, with the aim of developing methodological strategies for integrating these into the curriculum of the Initial, Basic and Middle levels, based on the conformation and training of strategic teams at the district level.
- Educational Computing Programs; Through this, installations of 52 Digital Libraries have been carried out within the framework of the Tele-education Project, creation and consolidation of the Educating Dominican Educational Portal, implementation of the Technological Corners Project in classrooms of the Initial Level, implementation of the Digital Boards Project that will benefit the centers of education of the public sector.
- Competitive Funds for the Development of Educational Innovations - Initial and Basic Education; Its purpose is to finance specific initiatives presented by

non-governmental organizations (NGOs), municipal governments, religious organizations and civil society in general to be executed in the public and private sector with the purpose of promoting policies and programs regulated by the SEE to increase the quality and efficiency of basic education in areas below the poverty line.

As of 2004, the office of the First Lady and the Dominican Institute of Telecommunications [INDOTEL] have the Community Technology Centers (CTC) project, facilitating access to Information and Communication Technologies (ICT) to more than 495 thousand Dominicans through their different projects. They currently have 101 CTC and have the following educational offer:

- Digital Literacy
- Office package
- Internet
- Photoshop
- Creation of Web Pages
- Introduction to Programming
- Fingering Techniques
- IT Essentials
- Business Presentation

In addition to other workshops and courses: Women in RED, B@chiNet, English by immersion, etc.

In the case of Higher Education Institutions in Dominican Republic in the Final Evaluation Report on the use of ICT in the Dominican Higher Education System (2014), it has been found that less than fifty percent (50%) of these are immersed in the Digital Age of the Information and Knowledge Society. Although it is noted that several private universities do extensive use of ICT in different areas of the process: teaching, administrative, services, etc.

In 2016, the government of the Dominican Republic launched the Digital Republic program, with the aim of promoting the inclusion of information and communication technologies in productive, educational, governmental and citizen service processes. This axis seeks to outline, implement and promote inclusive strategies that integrate Information and Communication Technologies (ICT) in the Dominican education system.

- Having as fundamental projects in the line of Education:
- Training in multimedia, software and networks, digital media and ICT tools.
- Training of human capital in software development.
- Healthy Internet (Safe browsing)
- Digital literacy plan.
- A computer for students and teachers of Higher Education.
- The web portal of scientific, technological and humanistic information.
- Development of technological-scientific competence.
- Student registration project.
- A student, a computer; a teacher a computer.

Achievements to March 2019:

- 147 schools integrated into the One to One
- 62,307 students benefited from laptops or tablets
- 639 schools equipped with robotics kits
- 333,289 students involved in robotics and science programs
- 3,000 teachers with laptops and access to an educational platform
- 5,700 students

Presence of Inclusive Education in the legislation of the Dominican Republic

The General Law of Education 66-97 (General Law of Education), as well as the Ten-Year Education Plan 2008-2018 (Plan Decenal de Educacion 2008-2018), are published, in different articles, the legal framework, for the achievement of the most genuine ideals of justice for everyone. The articles of the General Law of Education 66-97 that are related to educational inclusion are the following:

- Art. 4 (a) „... each person has the right to an integral education that allows the development of their own individuality and the realization of a socially useful activity; „How does it work?"
- Art. 48. „Special education is a subsystem that has as its object the attention with the levels of specialization required for children and young people who have disabilities or exceptional characteristics."
- Art.49. (b) „Offer special opportunities for talented students in order to enhance their special abilities in any of the fields in which they manifest."
- Art. 49 (c) „Offer disabled students training aimed at the integral development of the person and job training that allows incorporating the world of work and production."
- Art. 49 (d) „Promote the integration of the family and the community in special education programs. "According to the teaching career system of the Dominican Republic (2016), the minimum requirement to teach in the Dominican education system is to have a degree in education or professional qualification for teaching. The aspiring teachers of the Dominican Educational System have to participate in an opposition contest, which includes proofs of reasoning and logical judgment.

Inclusive Education in the Dominican Republic

Inclusive Education (Educando, 2011) is an educational model that seeks to meet the learning needs of all children, youth, and adults with special emphasis on those who are vulnerable to marginalization and exclusion.

In addition, it proposes a quality education for all students, regardless of their particular characteristics. The aim is that children and young people reach the maximum

level of development for learning, feel comfortable in their environment, and participate equally in school.

There are great needs for social inclusion in people with disabilities. According to information from the National Council for Persons with Disabilities (CONADIS) these constitute 10% of the population.

Due to the size of this segment, the Ten-Year Education Plan 2008-2018 refers to the need to take into account persons with disabilities, which are excluded from the right to Education. In 2013, the Ministry of Education of the Dominican Republic carried out a survey in 87% of public schools in the country, and the following data was found among others.

„About 48% of public schools in the DR have students with disabilities in their classrooms"

That 59% of these schools do not incorporate pedagogical strategies adjusted to develop the teaching-learning process in students with disabilities.

64% of public schools do not have specialized personnel to achieve the learning and school stay of students with disabilities.

We also found in the National Survey of Homes and Multiple Purposes (ONE, 2013):

7% of the Dominican population suffers from some type of disability, visual, intellectual, physical or motor, and 66% do not work. Visual disability is in the top of the list with 268,594 sufferers.

It is considered that, of 9,468,410 inhabitants, that the country has (according to the 2010 census), 708,597 are people with some disability, being 51.7% male and 48.3% female, and the most affected are people over 50 years old.

Regarding the academic preparation, 60.4% of the population with three years and more with some disability reached basic and primary studies.

42% of the 708,597 do not have health insurance and most live in concrete houses and zinc roofs. Among those with health coverage, 61.2% are affiliated with the SENASA state insurance.

After the visual disability, the second difficulty that affects this population is the permanent disability to walk, with 228,808 people, and the third one is the permanent difficulty to get up, with 165,792.

Fourth place is occupied by the intellectual disability and the fifth by arms related difficulties.

74% of people with disabilities live in the urban area. Specifically, the 36.7% is located in the Ozama or Metropolitan region.

The Dominican Republic signs the Marrakesh Treaty, which was ratified by the National Congress on June 27, 2017, and promulgated by President Danilo Medina on July 21 that year

Inclusion in the Dominican Republic. Initiatives of Interest:

Since 2008 the Dominican Republic has promoted different actions that have had as fundamental beneficiaries children, youth and adults who for some reason were or are at risk of being excluded from the education system. That is why the creation and strengthening of programs that served students at the Initial, Primary, and Secondary Level, either directly or transversally, have been encouraged.

The training of education professionals is present in all the actions that are promoted through continuous training processes. Conducting seminars and conferences to publicize the latest developments in the subject, the realization of calls for good practices to disseminate the initiatives that are generating changes in school culture, and the advice of Ibero-American experts to strengthen government agencies related to the education sector.

- Early action classrooms
- Collaboration with the Office of the First Lady or International Autism Congress
- Identification of barriers to learning
- Different research on Inclusive Education both at the governmental level and at different universities in the country.The research project was presented before the Bioethics Committee of the Catholic University of Santo Domingo. This was the first national attempt to obtain varied information from parents or caregivers of people with Autism Spectrum Disorders.

  Other studies of interest:
- The challenges of inclusive education in the Dominican Republic (Guzmán, 2015)
- The study „Children out of school in the Dominican Republic" (2017), conducted by the local office of the United Nations Children's Fund (UNICEF), in coordination with the Ministry of Education (MINERD).
- Disability in children and adolescents in the Dominican Republic: Analysis of situation and response (Miric & Pérez, 2015).

  In table No.2 you will find other projects of interest

Table 2. Projects of interest about inclusion in the DR

Projects	Websites
In the National Library Pedro Henriquez Ureña is created: USEPEDI. Accessible services for all.	http://www.bnphu.gob.do/servicios/usepedi
Comprehensive Center for Disability (CAID) (Office of the First Lady)	https://primeradama.gob.do/index.php/noticias/item/846-caid-aplicara-tecnologia-para-mejorar-la-vida-de-ninos-autistas
The Association of Persons with Physical Motor Disability (ASODIFIMO),	https://www.dominicanasolidaria.org/organizacion/asociacion-personas-discapacidad-fisico-motora-inc-asodifimo/

Projects	Websites
Circle of Women with Disabilities (CIMUDIS)	http://boletincimudis.blogspot.com/
Ibero-American Network of Entities for People with Physical Disabilities (The Network)	https://www.dominicanasolidaria.org/organizacion/la-red-iberoamericana-entidades-personas-discapacidad-fisica-la-red/
Dominican Foundation for the Blind (FUDCI)	https://www.foal.es/es/asociaciones/fundacion-dominicana-de-ciegos-inc
Civil Society Council for the Cabinet for the Coordination of Social Policies	https://gabinetesocial.gob.do/el-gabinete-social/composicion-del-gabinete/consejo-consultivo/
National Council on Disability (CONADIS)	http://conadis.gob.do/
Nido para Angeles Foundation. Institution that provides therapeutic and comprehensive services for children with cerebral palsy.	https://nidoparaangeles.com/npa/
Dominican Association of Down Syndrome	http://adosid.org/
National School for the Blind	http://hoy.com.do/escuela-de-ciegos-celebra-60-anos-existencia/
National School for the Deaf	http://www.escuelaparasordosdnrd.edu.do/
The National University Pedro Henriquez Ureña includes in its educational offer the Career of Special Education	https://unphu.edu.do/grado/facultad-de-educacion-y-humanidades/sobre-las-escuelas/escuela-de-educacion-especial/carrera-de-educacion-especial/
Governmental Project Digital Republic	https://republicadigital.gob.do/
The University of the Caribbean (UNICARIBE) signed an agreement with the National Council on Disability (CONADIS)	https://www.unicaribe.edu.do/noticias/unicaribe-comprometida-con-la-inclusion/

Source: Prepared by Authors

Challenges and the use of technological innovation

According to the technical notes of Navarro (2009) for the IDB, the Dominican Republic has „very low level of investment on research, development and innovation: the resources channeled to these activities barely reach 0.25% of GDP" and that the majority of these resources are: the public sector and the private sector.

With the Decree of the Executive Power No. 190-07 „The National System of Innovation and Technological Development (SNIDT) is created, with the objective of articulating in a functional way, the network of institutions (academic, public, private and international), and public policies, in order to promote innovation and applied technological development, searching to rise competitive capabilities of the strategic sectors and groups of the Dominican Republic, promoting the integration of their value chains, from innovation to production and marketing" (Presidencia de la República Dominicana, 2007).

The note published by the IDB lists some of the initiatives and policies in the country regarding innovation, such as the National Fund for Scientific and Technological Innovation and Development (Fondocyt), which was born after the enactment of the law creating the MESCyT (Old SEESCYT) in its article 94; Cybernetic Park Santo Domingo; Dominican Network of Business Incubators and Entrepreneurship (Dominicana Incuba); Integration of universities to the national innovation system; Technological services offered by public and private providers.

Another initiative to promote innovation on the part of the government was the implementation of the „Science, Technology and Innovation Strategic Plan 2008-2018", which proposes different goals, programs and subprograms linked to its objectives.

On the other hand, Navarro (2009) states that among the challenges presented by the Dominican Republic in terms of technological innovation are the large investments in technological equipment, minimum physical and human infrastructure and the need for institutional strengthening of the public sector.

Blockchain

In a statement in 2017 the Central Bank of the Dominican Republic will see that „... virtual assets such as Bitcoin, Litecoin and Ethereum, do not have the support of the Central Bank and therefore do not enjoy the legal protection granted by the Legal framework of the Dominican Republic In the same way, they cannot be used like other currencies under the exchange regime, since they are not issued nor are they under the control of any foreign central bank, which is why the guarantees are not the security offered by the exchange intermediary or the „Free convertibility, enshrined in articles 28 and 29 of the Monetary and Financial Law".

This means that, although in the country it is not considered illegal to acquire or market this type of virtual currency at the national level, those who carry out transactions assume the risks that may arise from its use and the loss of all legal protection. In the country, there are different companies that are dedicated to the purchase and sale of Bitcoins, as is the case of BitcoinRD, that does it from its website, and some have different ATMs at the national level, such as BitRD.

Global Sharing Pedagogy

In the country, there are organizations that offer this type of learning such as AFS Dominican Republic, which is responsible for preparing the leaders of the future by improving their competence and intercultural skills to have a positive impact in a globalized world.

Another initiative offered by the State Department of the United States, through the American Embassy in Santo Domingo, is the „Global Exchange Program (UGRAD)", which is responsible for awarding scholarships to undergraduate students from more

than 55 countries, to be inserted during a semester in American universities, where it is exposed to the culture, society and American educational system, with the aim of forming leaders in their professional area and serving as a link between cultures.

On the other hand, the Global Democracy and Development Foundation (FUNGLODE), has the „Dominican Global Academic Exchange Program" which, in collaboration with universities such as Yale, promotes learning and innovation. During the exchange, students learn about the daily life of these Dominican-American university students, and have as objectives economic development and entrepreneurship among young Dominicans and also create a link between the student and the diaspora.

In addition, some of the universities internally have student mobility programs to different countries to promote cultural exchange and improve the skills of students.

Digital Storytelling

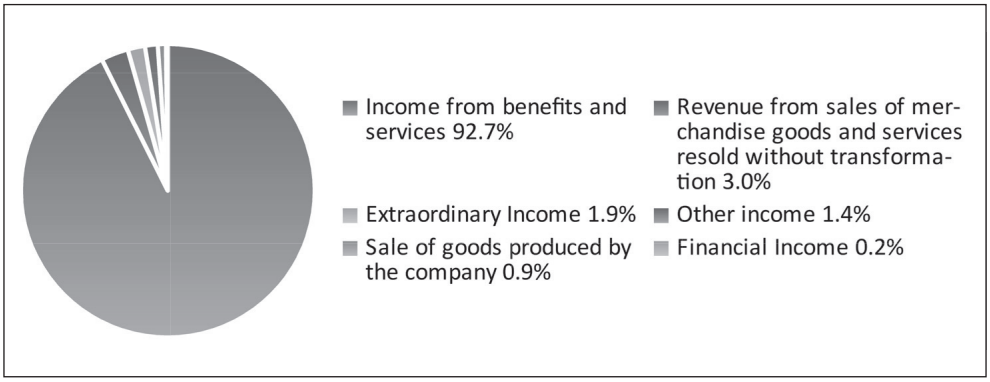
The successful national and international companies that are in the Dominican Republic are using the digital marketing tool „Storytelling", to get closer to their clients through the stories that have their products or services, in order to positively impact on the image of these companies. Among these are: Coca Cola Dominicana, Grupo CCN, MercaSID, etc. There are different advertising companies in the country that are responsible for the design and publicity of these stories, such as the Liquid agency.

The Business aspect of ICT in education and inclusion in Dominican Republic

There are many companies and institutions that use educational software and e-learning platforms, mainly used by universities such as UAPA (www.uapa.edu.do) UNIBE (www.unibe.edu.do), INTEC (www.intec.edu.do), UNAPEC (www.unapec.edu.do), UNICARIBE (www.unicaribe.edu.do), UFHEC (www.ufhec.edu.do) among others, there is currently no official report that indicates what is the total that uses them or that is dedicated to the business of educational ICTs. However, recently the company Okus, with support from the National Fund for Innovation and Scientific and Technological Development (FONDOCYT), the Ministry of Education Science and Technology (MESCyT), the Korean Cooperation Agency (KOIKA) and the KAIST, are leading a project that offers virtual assistance to teachers in the subject of mathematics, virtual tutoring for students and intelligent assistance for parents to follow up their children. Currently they are taking a pilot at an Educational Center in Santo Domingo East, but for the 2019-2020 period, they are looking to implement it in 15 more centers. Also there are some software in DR Market for academic management such us Banner (https://softwareconnect.com/erp/sungard-sct-banner-e-education/), Xtudia (http://xtudia.com), Tecklas (https://tecklas.com/), Jenzabar (https://www.jenzabar.com/), Academitek (www.academitek.com)

According to the Directory of Companies and Establishments (DEE) of the National Statistics Office (ONE) of 2016, there were 1502 ICT companies in the country representing 2.1% of the economic activities, of which 72.5% were made up of 1-9 employees. These companies were located in 1755 establishments nationwide of which 68.61% were present in the province of Santo Domingo and the National District; The economic income of companies dedicated to ICTs according to the 2016 national economic activity survey, for fiscal year 2015 amounted to RD$ 252,488.14.

Figure 1. Percentage distribution of nominal income of companies in the information and communications sector, according to 2015 components.



Source: Oficina Nacional de Estadística (ONE), Resultados preliminares de la Encuesta Nacional de Actividad Económica (ENAE) 2016.

Table 3. Profitability of companies in the Information and communications sector, 2015

Components	Millions RD$
Profitability	21.7%
Profit of the year*	54,769.80
Income	252,488.14

* The profitability is equal to the profit of the year on the income.

Source: *Oficina Nacional de Estadística (ONE), Resultados preliminares de la Encuesta Nacional de Actividad Económica (ENAE) 2016.*

Recommendations for SELI project in Dominican Republic

This is not an exhaustive list, but they are the most important elements to take into account to guarantee the success of the project:

1. Know the context and reality of Dominican Republic
2. Involve the main stakeholders in the activities to be developed, eg: Policy makers, NGOs, educational institutions

3. Adjust the activities to be developed according to the needs of the country and recommendations from stakeholders
4. Work with several excluded groups, at least 2-4
5. Planning activities with enough time and develop and effective communication plan

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DIGITAL LITERACY AND ICT IN LEARNING AND INCLUSION - ECUADOR

Abstract: This chapter examined digital literacy in Ecuadorian society and in its educational system. The primary interest was to identify current levels of digital literacy among Ecuadorians, more specifically the levels of digital literacy in historically underrepresented groups. A secondary purpose was to examine digital literacy in schools, placing special interest in government programs for the inclusion of information and communications technology (ICT) in learning. This chapter was organized as follows: first, 2017 survey data from the National Institute of Statistics and Census (INEC) were used to illustrate current levels of use and access to ICT in the society. Profiles of digital illiteracy groups were created and analyzed based on their characteristics. Second, data provided by the Ministry of Education were used to examine current levels of ICT inclusion in schools. Lastly, government plans for ICT inclusion of pre-service teachers and in-service teachers were discussed.

Keywords: ICT, Ecuador, Digital literacy, learning, Ministry of Education

Introduction

Links between digital illiteracy and social exclusion have clearly increased the political spotlight on inequalities around access and use of new technologies, especially because of the potential benefits that addressing differences in access to ICTs could bring to historically underrepresented and vulnerable groups (Helsper, 2012).

For the last decade, Ecuador has made great strides in increasing digital literacy (Viecens & Callorda, 2016) by making digital inclusion a political priority. In order to grant access to internet and telecommunication technologies for all of their inhabitants, the Ecuadorian government has outlined the National Plan of Telecommunications and Technologies (Ministerio de Telecomunicaciones y de la Sociedad de la Información - MINTEL, 2016a). The plan involves identifying and implementing programs to promote

access and use of ICTs though the development of infrastructure, regulations and legislative reforms in order to support economic development, social progress, and education reform in the country (Tirado, Mendoza, Aguaded, & Marín, 2017). Digital literacy can only be reduced under certain circumstances: first, where there is the capacity to provide and maintain free or very low price cost infrastructure in sustainable ways; second, when training opportunities are provided, and third, when qualified educators are available (Osterwalder, 2002). Thus, the plan included several steps to address common implementation challenges such us limited infrastructure for ICT access, limited availability of technically skilled support and maintenance staff, and under-qualified teaching staff (MINTEL, 2016a).

Ecuadorian Context

According to the National Institute of Statistics and Census (INEC) 2017, Ecuador had a population of 16'777.000 inhabitants. The majority of the population was female (50.02%) compared to 49.98% of males. The majority of the population falls within the 15-64 age range; approximately 28% are children between 0-14 years old, and 7.10% are adults older than 65 years old.

Gilster (1997) defined digital literacy as the ability to access networked computer resources and use them. In Ecuador, INEC defined digital literate as a person who has access to computers, internet, and cellphones. According to MINTEL's 2017 report, approximately 60% of the population older than 5 years of age, living in urban areas, used a computer, compared to 36% in the countryside. Slightly over half of the population (52%) accessed or used a computer nationwide, representing an increase of 13.3% since 2012. The report also showed that 80% of the population accessed or used the internet and that over the last five years, access to the Internet has increased from 22.5% in 2012 to 37.2% in 2017. In rural areas, during the same period of time, the increase was of 11.8%, suggesting an increase in digital literacy. However, there is a tendency for individuals to reduce access and use of ICT as they get older. 48% of young adults (35 - 44 years old) reported using computers, compared to only 35% of individuals between the ages of 45 and 54. The usage is less for older populations; 22% for individuals between 55 and 64, and only 6% for people older than 65. The same tendency held for access or use of internet and technological devices such as smartphones (MINTEL, 2017a). On the contrary, the proportions of younger individuals between 16 and 24 years old who used a computer was over 78 % and 85% for internet usage.

In terms of geographical location, MINTEL (2017a) reported that the majority of the urban population (57.25%) accessed the internet from their homes, compared to only 5.4% from an educational institution, and 16.3% from Community Info-centers. In contrast, in rural areas the percentage of people who access the internet from their homes drops to 38.2. The proportion of individuals who accessed the internet from an educational institution

increased to 14.3%, and the proportion of people accessing the internet from community centers doubled to 33.1% suggesting an increase in digital literacy in rural areas.

The most common reasons for ICT use are: 1) to obtain information. 42% of the population in urban areas uses ICTs to gather information, compared to 34% in rural areas. 2) For communication purposes, approximately 30% for both areas. 3) Educational purposes, 28% in the countryside compared to 19% in the cities. Gender seemed to have no impact on reasons for ICT usage among the population (Torre-Diaz & Duart, 2015). Nevertheless, the percentage of females considered digitally illiterate is higher than it is for males (MINTEL, 2017a).

Research has established that race and ethnicity (Mesch & Talmud, 2011), gender (Ono & Zavodny, 2008), age (Parker, 2011), and socio-economic status (Witte & Mannon, 2010) can be determinants of internet usage and proficiency (Bawden, 2008; Martin, 2006). Thus, digital inequalities can reinforce existing social inequalities and even exacerbate them because they carry over preexisting differences in human capital into online settings (DiMaggio & Garip, 2012; Helsper, 2012). At the student level, for example, Torres Diaz and Infante Moro (2011) found that among Ecuadorian college students, income had the greatest influence on years of experience, time spent-online by session, and frequency of internet use. Income was a determining factor in relation to both computer and internet knowledge. Similar findings were reported by Torres-Diaz and Duart (2015) in their study about the effect of students' family income, gender, and age on internet use for academic activities and entertainment purposes. The results showed that among college students, the higher the level of family income, the better the technology use for academic activities. Regarding internet use for entertainment, the level of income did not determine the intensity of technology use, though it did determine the types of tools used by students. With reference to gender, men had a greater tendency to use technology for entertainment; however there is no difference between genders when it comes to academic uses.

Research has shown that these factors not only affect college students but also other population groups . In regard to secondary school students, Tirado et al. (2017) in their study of the impact of sociodemographic status on the digital divide, found that the influence of family income and level of education of the parents is higher regarding physical access to internet, similar results were reported by Monteiro and Leite (2016). However, their influence of having access to internet decreased with regard to more complex levels of internet usage such as analytical and evaluation skills and the ability to create digital content. The authors concluded that high levels of family income and parents' education did not guarantee skilled individuals; although it may be a risk factor for students from lower statuses.

Considering that access and use of the Internet relate to the degree to which individuals develop ICT skills, how knowledgeable they become about valid and reliable sources of information, and develop abilities to create digital content and academic use of the internet (Tirado-Morueta et al., 2017), the Ecuadorian government has outlined the National Plan of Telecommunications and Technologies (MINTEL, 2016a). In line with the objectives of

this plan, the government created *Community Infocenters*. Community infocenters are places where ICT access is guaranteed for all citizens and the democratization of ICT is ensured. Their main purpose is to reduce the digital divide, encourage innovation, entrepreneurship and development through universal access to ICT (see https://infocentros.mintel.gob.ec/). According to MINTEL's last report, national access to the internet has increased 14.7 percentage points in urban areas and 11.8 percentage points in rural areas compared to 2012.

As part of Ecuador's plan to reduce the digital literacy gap, internet access has also been supported by offering citizens low internet costs. The country has the least expensive fixed broadband plans for the residential segments, offering above average speed with lower prices, when compared to other countries in the region (Viecens & Callorda, 2016). The prices of mobile data plans for smartphones are also below average and provide services such as WhatsApp, Facebook, and Twitter to mobile telephony users without having to pay for extra data use (Viecens & Callorda, 2016). Although the prices of internet connectivity are decreasing progressively, the prices of the equipment (desktop computers, laptops, tablets, smartphones, smart television), are still high when compared to the cost of living in Latin American countries (ITU, 2014).

Additional efforts to align educational models, institutional strategies, and public policies are needed in order to adequately incorporate ICTs in education (Vinueza & Gallardo, 2017). This can only be achieved by the allocation of necessary economic resources, qualified personnel, and training plans. The implementation of new strategies into educational models can be achieved by implementing innovative instructional methods and technologies. Villafuerte and Romero (2017) examined learners' attitudes towards practicing English Language on Social Networks Sites. The results revealed that college students have positive attitudes towards the use of social network sites to practice English. Furthermore, they prefer YouTube and Google+ for their easy access and flexibility to strengthen listening, reading and comprehension skills in English. Finally, Facebook, and WhatsApp can be used to motivate reading, writing, and speaking practices, although preferences varied depending on learners' age. Similarly, Arteaga and Rodas (2018) found that the use of virtual learning environments, had a positive effect on college students' listening skills when learning a foreign language.

Nevertheless, in order to achieve social and economic development of the country, it is imperative to spread the focus of these regulations and reforms to include marginalized groups of the population. Llerena, Oyaque and Jiménez (2018), in their study of digital illiteracy, found that factors such as age, economic activity, geographical location, level of education, and time allocation for activities such as household, childcare, or farming over training strongly influence ICT use. These findings are consistent with those of Roca (2016), who affirmed that among young Kichwas, even when having necessary technological facilities to support internet and ICT connections in rural communities, they use internet more frequently to do homework or school related activities that for the use of social networks, and even less frequently for other purposes. Others have argued that digital

competency, digital use, and digital transformation should not be limited to an instrumental learning of technologies, but must go beyond and generate intellectual capacity in citizens to filter and evaluate information, encouraging and improving citizen participation, social control, and anti-corruption struggle, even in areas far from the urban boundary.

Some have gone beyond rural and urban boundaries to reach other populations and increase digital literacy. Quinde et al. (2018), for example, developed a piece of multimedia didactic material through gamification techniques for digital literacy of incarcerated individuals. They found that the appropriate use of ICTs and gamification contributed as a tool for digital literacy in imprisoned people and may facilitate their reintegration into society. ICT provide the opportunity to reach out to all groups of people. Nevertheless, special considerations must be included in the design to address limitations such as limited access to an internet connection, full use of the computer, and especially the limited time that exists for digital training.

This study was guided by Llerena, Oyaque and Jiménez's (2018) findings and grounded in Helsper's (2012) theoretical model to understand the links between social and digital exclusion. The authors suggested that digital exclusion may be the result of the combination of a number of factors. These factors are: age, gender, ethnicity, location, level of education, and economic. We argue that, in order to better understand societal characteristics influencing digital literacy, it is necessary to analyze the profiles of digitally illiterate groups and how the intercorrelation among factors influenced levels of digital divide in society. INEC (2017a) defines digital illiterate as a person between 15 and 49 years old who simultaneously fulfilled the following characteristics: 1) did not possess an active cell phone; 2) had not used a computer within the last 12 months; and 3) had not accessed the internet within the last 12 months. In order to better understand the differences between digital illiteracy in the population, our study was not limited to the age range provided by INEC; instead, we organized digital illiteracy levels by groups of ages increasing by 10 years each (Parker, 2011). Digital illiteracy was a dichotomous variable indicating if the person was considered digitally illiterate (1) or not (0) (MINTEL, 2017a). Other factors included in this analysis were: individual's age, gender, ethnicity (self-identification), location, (urban – rural), level of education, and a multidimensional of poverty index (see Parámetros de Revisión Estadística – Umbrales de capacidad inferencial, INEC, 2016).

Digital Illiterate Individuals

This study used ENEMDU 2017 (INEC 2017b) data to analyze economic, cultural, social and personal characteristics of digital illiterate individuals. From a sample of 114,086 people, 22.4% were identified as digitally illiterate. We examined the characteristics of these 25,535 individuals. Table 1 shows that 56.6% of the digitally illiterate population is female compared to 43.4% of males. 59.7% of digital illiterate people live in rural areas and 40.3% live in cities. The multidimensional poverty index (INEC, 2016b) classified as poor 44.0

% of digital illiterates, while 55.4% were considered not poor. In terms of ethnicity, 66.4 % of digitally illiterate individuals identified themselves as mestizos. Indigenous are the next highest percentage, 23.9% of digital illiterate individuals; whereas the other ethnic groups are relatively small, around 2%. Finally, in terms of age, the higher percentage (21.5%) of digital illiterates was people 65 years old and older, compared to younger people, which percentages were smaller than 10% with the exception of children younger than 15 (35.1%).

With regard to levels of education among the digitally illiterate, we can see that over 35% of the population had only elementary or basic education. 13.3% had high school education and 11.4% had no education at all. The proportion of people who attended literacy centers was 0.8%. Surprisingly, around 1% of digitally illiterate people held associates, bachelors, or postgraduate degrees.

Table 1. Frequencies and percentages of digitally illiterate individuals by factor (N= 25,535)

Variable	Frequencies	Percentages
Gender (Female)	14,441	56.6 %
Location (Urban)	10,278	40.3 %
Poverty level (Poor)	11,243	44.0 %
Ethnicity		
Afro-Ecuadorian	385	1.5 %
Negro	533	2.1 %
Mulato	326	1.3 %
Montubio	801	3.1 %
Mestizo	16,951	66.4 %
Blanco	424	1.7 %
Indigenous	6105	23.9 %
Age Groups		
5-15	8,971	35.1 %
16-24	1,825	7.1 %
25-34	2,179	8.5 %
35-44	2,304	9.0 %
45-54	2,357	9.2 %
55-64	2,412	9.4 %
65+	5,483	21.5 %
Level of Education		
None	2,902	11.4%
Literacy center	205	0.8%
Elementary school	9,155	35.9%
Basic Education	9,582	37.5%
High school	3,406	13.3%
Associate's Degree[1]	35	0.1%
Bachelor's Degree[2]	244	1.0%
Postgraduate	6	0.02%

Source: ENEMDU 2017. Self-elaborated

Table 2 shows that the majority of digitally illiterates only had elementary or basic education, 55.3 % and 5.3%, respectively. 20.5 % were people who had a high school education and 1.72% held higher education degrees. 16% of the digitally illiterate population had no education at all and 1.2% reported having attended a literacy center. Data were organized in terms of education level and age group. This quantification revealed that 54 digitally illiterate individuals holding degrees beyond high school were between 55 and 64 years old, and that 76 of them were 65 years old or older.

Table 2. Frequencies and percentages of digitally illiterate education level (N= 16,564).

Level of Education	Frequency	Percent
None	2,643	16.0 %
Literacy center	205	1.2%
Elementary	9,155	55.3%
Basic Education	882	5.3%
High school	3,394	20.5%
Associate's degree[10]	35	0.2%
Bachelor's degree[11]	244	1.5%
Postgraduate degree	6	0.02%

Source: ENEMDU 2017. Self-elaborated

In regard to the differences between gender and age groups, higher proportions of older people were categorized as digitally illiterate. The difference in males and females between 16 and 24 years old was 8.8 percentage points. Whereas, differences increased as tens of years increased. This is, the proportion of digital illiterate females was 21 percentage points higher than males between 25 and 34 years of age. 31% more females between 35 and 44 years of age were digitally illiterate. The gaps are similar for older populations, 24.4%, 23.6%, and 14.6%, respectively. These results are displayed in table 3.

Even though the percentage of digital literacy has increased for individuals between 15 and 49 years of age from 78.6% in 2012 to 89.5% in 2017, nationwide (MINTEL, 2017a), significant differences in access still exist between urban and rural areas. As shown in Table 4, we further organized the data by geographical location. We found that rural areas still had higher proportions of digital illiteracy. There were a higher

[10] Associate's Degree: A degree usually awarded for the completion of at least two years of full-time academic study beyond high school, typically at the community college level.

[11] Bachelor's Degree: A degree usually awarded for at least four years of full-time academic study beyond high school.

proportion of males between 16 and 54 living in the countryside, approximately 35%. The proportion drops to 15.74% for men between 55 and 64. However, for males older than 65 the difference is about 10%, suggesting that for men older than 65, location may not make a difference. Similar patterns held for females.

Table 3. Frequencies and percentages of digitally illiterate differences between gender and by groups of age (N= 16,564).

Age Group	Males		Females	
	Frequency	Percentage %	Frequency	Percentage
16 - 24	833	45.6%	992	54.4%
25 - 34	860	39.5%	1,319	60.5%
35 - 44	794	34.5%	1,510	65.5%
45 - 54	892	37.8%	1,465	62.2%
55 - 64	921	38.2%	1,491	61.8%
65+	2,339	42.7%	3,144	57.3%

Source: ENEMDU 2017. Self-elaborated

Around 47% of digitally illiterate women between 16 and 34 years of age lived in rural areas; 35% of women between 35 and 44, and 23% of females between 45 and 54. Interestingly, there were 5% more digital illiterates older than 65, in urban areas.

Table 4. Frequencies and percentages of digitally illiterate individuals by area, gender, and groups of age (N= 16,564).

Age Groups	Urban				Rural			
	Male		Female		Male		Female	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
16-24	270	32.41%	263	26.51%	563	67.59%	729	73.49%
25-34	295	34.30%	358	27.14%	565	65.70%	961	72.86%
35-44	263	33.12%	492	32.58%	531	66.88%	1,018	67.42%
45-54	285	31.95%	568	38.77%	607	68.05%	897	61.23%
55-64	388	42.13%	663	44.47%	533	57.87%	828	55.53%
65+	1,064	45.49%	1,644	52.29%	1,275	54.51%	1,500	47.71%

Source: ENEMDU 2017. Self-elaborated

Poverty has been identified as a limiting factor related to ICT access and use (Torres-Diaz & Infante Moro, 2011) as they are a function of age, family income, and socio-economic status (Torres Diaz & Duart, 2015). Table 5 presented proportions of digitally illiterate people classified as poor and not poor (INEC, 2017) by age groups.

As shown in table 5, similar differences help for people classified as poor and not poor, between 16 and 44 years old. In contrast, the proportion of digital illiterates increased by 14 percentage points for not poor individuals. The difference was even wider for people over 55 and over 65, 32% and 38.6%, respectively. These results suggested that age may have a stronger impact than poverty on digital literacy.

Table 5. Frequencies and proportions of digitally illiterate individuals by poverty level and age groups (N=16,564).

Age groups	Not poor		Poor	
	Frequencies	Percentage	Frequencies	Percentage
16-24	887	48.9%	928	51.1%
25-34	996	46.0%	1,167	54.0%
35-44	1,120	49.0%	1,166	51.0%
45-54	1,335	57.0%	1,006	43.0%
55-64	1,573	66.0%	810	34.0%
65+	3,776	69.3%	1,670	30.7%

Source: ENEMDU 2015. Self-elaboration

Finally, we analyzed digital literacy among ethnic groups. Table 6 shows that the majority of digitally illiterates identified themselves as Mestizos (67%). The next biggest proportion is Indigenous with 23.4% and lastly, Montubios with 3.1%. According to MINTEL (2017a) the majority of Mestizos, Indigenous, and Montubios lived in rural areas. The other ethnicities were presented in proportions around 2% or less.

In sum, although according to INEC's report (2017a), digital literacy has increased from 78.6% in 2012 to 89.5% in 2017, this study shows that this increment may still not be a reflection of the inclusion of historically underrepresented groups. In spite of government efforts to increase ICT inclusion (e.g., Community Infocenters, low prices of broadband (Viecens & Callorda, 2016) people in rural areas still report lower rates of ICT access, especially women. We found that the highest proportions of digitally illiterate individuals are females, from all age groups, living in rural areas. This is consistent with the results presented by Roca (2016), who argued that women, living in the countryside, prioritize farming activities or childcare over ICT use. These results also support the argument proposed by Llerena, Oyaque and Jiménez's (2018) research in regard to the influence that economic activity, geographical location, level of education, and age have on digital illiteracy.

Table 6. Frequencies and proportions of digital illiterates by ethnic group (N=16,564)

Variable	Frequencies	Percentages
Indigenous	3,878	23.4%
Afro-Ecuadorian	237	1.4%
Negro	318	1.9%
Mulato	202	1.2%
Montubio	517	3.1%
Mestizo	11,093	67.0%
White	311	1.9%
Other	8	0.05%

Source: ENEMDU 2015. Self-elaboration

The results presented above suggested that age may be a key factor related to digital literacy, since the proportion of digital illiterates seemed to be highest among people over 50 years of age. With respect to ethnicity, we found that the majority of digital illiterates are mostly Mestizos (e.g., Montubios) and Indigenous people who live in rural areas. 41.4% of the Indigenous population in Ecuador is digitally illiterate, 44.3% of Afro-Ecuadorians or Black, and 25.6% of Montubios, suggesting the need for more programs, not only for ICT training, but also to provide information about the benefits of its use. These findings were consistent with the ones presented by Stefos, Castellano, Marchán, and Biloon (2017).

Digital literacy in Schools

During the last decade, Ecuador has made great efforts to improve its education system. Policies have been implemented to foster and guarantee social and territorial equity, cohesion, inclusion, and equality in education, especially for marginalized groups such as women, indigenous, Afro-Ecuadorian, rural, poor, and those with disabilities (Cevallos Estarellas & Bramwell, 2015; National Secretariat of Planning and Development, 2013). Representatives from the MINEDUC, teachers, parents, and stakeholders developed a Ten Year Education Plan with the purpose of improving education. This plan included aspects such as the implementation of new curriculum, standards, and technology. Additionally, proposals for professional development and ICT support were introduced in the plan in order to improve teaching and learning process (MINEDUC, 2007).

For example, since 2010, MINEDUC has executed the project „Integrated System of Technologies for School and Community - SITEC. The main objective of this project is to implement an integral system of technologies in public schools, facilitate educational management through the online generation of academic records, increase professional competences in teachers, and promote the use of technology in learning (MINEDUC,

2016). SITEC is a collaborative project between two ministries MINTEL and MINEDUC; and had three components:

1) Provision of internet and technological tools for schools and educators and promotion of use and integration in the teaching-learning process, as well as of administrative tasks related to the educational platform of the Ministry of education.
2) Development of virtual content for educational purposes, and
3) training on how to use technological tools and virtual platforms for all educational actors.

As for the first component, MINTEL compromised to provide internet access for public schools nationwide. MINEDUC, on the other hand, was responsible for installing and providing at least one computer for every 10 students (only in educational institutions with at least 200 students), in order to ensure an adequate level of equipment availability in the educational process. Additionally, computer rooms would be equipped with multimedia projectors, and multimedia boards (MINTEL, 2016a). MINTEL and MINEDUC are in charge of monitoring and evaluation of the project's impact on ICT inclusion in education. To date, however, no reports were found about implementation or evaluation of the SITEC project.

As part of SITEC's first component, two pilot projects were launched. First, in 2014, 46,150 teachers were provided with personal computers (laptops). It was expected that the rest of the teachers would receive a technological kit (laptop, padlock, backpack, mouse and insurance policy) in 2017 (MINEDUC, 2016). However, as of 2018, not all of them have been delivered (Ponce & Rodas, 2018). Second, in 2015, the project „Use of tablets in the classroom" was implemented. Its main aim was to analyze the effect of the use of technology in the classroom, particularly the use of tablets on student achievement. The project consisted of providing each beneficiary student with a tablet, to be used in her/his learning process. The tablet had to be used by each student during three consecutive school years, with the accompaniment of the same teacher during this period. The use of the devices was controlled by teachers, with the support of a computer platform. 4,426 students from 2nd to 5th grades, in 58 public schools participated in this study.

Ponce and Rosales (2018) evaluated the impact of these two technological interventions on student academic achievement. They used a pre-test post-test approach to assess its impact on achievement. Two standardized tests, one for Language and Literature (EGRA) and one for Mathematics (EGMA) were applied to children from 6 to 9 years of age, to establish a baseline and to measure whether there was an increase in student achievement. Tests were applied twice, first at the beginning of the school year and then at the end of the same year for both treatment and control groups. The results showed a positive relationship between the use of tablets in the classroom and language learning; whereas in the case of laptops distribution, positive associations were found between laptop use and mathematics learning but only during the first year of the intervention.

Other projects have been employed to improve student achievement. "More technology", for example, was a program implemented in one of the biggest cities in the country.

This program provided computers and software to facilitate Mathematics and Language instruction in elementary schools, grades three to five. Over 400 schools received basic infrastructure for computer labs and four computers per school. All computers contained software specifically designed to facilitate students' Math and Language learning. The software personalized the curriculum of each student based on initial assessment results. Students had to use the software at least three hours per week. In addition, a comprehensive plan of teacher training was implemented. The training included general computer lessons as well as training on software usage. Carrillo, Onofa and Ponce (2011), in their study about the impact of More Technology program on Math and Language, found that the use of the software had a positive impact only on Mathematics test scores; although, the effects were heterogeneous among students. In other words, students at the top of the achievement distribution benefited the most from the intervention. Therefore, the authors suggested that such programs may increase the performance gap between those students at the top and those at the bottom of the achievement distribution. Finally, Stefos, Castellano, Marchán, and Biloon (2017), in their longitudinal comparative analysis between non-indigenous and indigenous students in basic education, found that the latter may experience double digital divide. The authors claimed that the first divide is with respect to the low percentages of use and employment of ICT in relation to developed countries; and the second gap is internal, between indigenous and non-indigenous youth.

In order to gain better insight about the current situation of ICT inclusion in educational institutions in the country, the authors analyzed whether or not a school has met digital expectations established in the Ten Year Program (2007). Using data collected and provided by the Ministry of Education (Archivo Maestro de Instituciones Educativas - AMIE 2017-2018) and building upon MINEDUC goals, the authors created a new variable, named *Met Digital Expectations* (MDE). The new variable was a composite measuring whether or not schools: 1) had internet access, 2) met the 1:10 computer - student ratio, and 3) had educational software. This analysis included all schools instead of only schools with at least 200 students, as proposed by MINEDUC (2016). As a means to create a school profile, the following characteristics were included: school's type of support (public, private), location (urban, rural), along with student body characteristics (e.g., gender and ethnic).

In 2016, MINEDUC asserted that in 2014 only 3,535 (45.6%) schools had access to the internet. Surprisingly, the results of our analysis showed that for the beginning of the 2017-2018 school year, out of 14,600 schools, only 45.4% (7,551) had access to internet; only 11.8% (10,527) had some kind of educational software, and just 14.2% had achieved the goal of student to computer ratio of 10 to 1. Table 7 presents descriptive statistics for the schools which had met the threefold digital expectation of having internet access, educational software, and a student to computer ratio of 10 to 1.

As we can see, only 30.4% of schools which had met the goal are located in rural areas compared to 69.6% located in urban areas. 63.3% of schools are private compared

to only 36.7% public schools. In regard to school size, schools ranged from 1 student to 2,359 (Mean = 251.7, SD = 329.1). Finally, in terms of students ethnic groups served by the schools, in over three quarters of the schools the majority of students were Mestizos (98.7%, Mean = 89.2, SD = 20.8). The highest quartile of schools served only 12.23% of Indigenous students (Mean = 16.3, SD = 29.9, and 3.45% of White students (Mean = 3.81, SD = 7.5). Montubios and Black are the less frequently represented in these schools. Merely 3.15% of Black students and 1.3% of Montubio students attended to these schools. Additionally, these ethnic groups only account for 77% and 36% of the whole student population within these schools. On the other hand, 11,611 schools did not meet the digital goal by the beginning of 2017-2018 school year and only 5.95% of schools with at least 200 students has achieved the goal of 1 to 10 student to computer ratio.

Table 7. Frequencies and proportions of school which met the digital expectations (N=1,029)

Variable	Frequencies	Percentages	Mean	SD
Location (Urban)	3,360	69.6%		
Type of school (Public)	11,243	36.7 %		
School size			251.7	329.1
Student gender (Females)	43,06	48.3%		
Student Ethnicity				
Mestizo		98.7%	89.2	20.8
Indigenous		12.2 %	16.3	29.9
White		3.5 %	3.8	7.5
Montubio		1.3 %	2.1	5.1
Black		3.2 %	3.3	7.7

Source: AMIE 2017-2018. Self-elaborated

In sum, out of 14,600 schools in the country, only 3,569 have met the goals proposed by MINEDUC, and still 2,622 schools function with no access to the internet, no computers, and no educational software whatsoever. The majority of those schools serve Mestizos and Indigenous students, and they are mostly located in rural areas; although differences in terms of location were very small. More evidence is needed in order to make claims about reduction of the digital gap and ICT inclusion in education.

Teacher use of ICT in Education and Teacher Education

Research shows that technology adoption and usage depends on the level of acceptance users have (Legris, Ingham & Collerette, 2003). In their study, Ramírez, Sabaté and Llinàs (2016) argued that the success of an e-learning system depends largely on the acceptance and use that teachers give to a tool. The authors built a conceptual model to evaluate technology adoption and to predict the level of acceptance and use of an

e-learning system among college teachers in Ecuador. The results indicated that perceived ease of use and perceived usefulness directly affected teachers' intentions of using e-learning systems. In addition, enjoyment, ease of use, and social influence had a direct effect on how useful teachers perceived the usage of e-learning systems. In the same way, when teachers enjoyed and felt self-efficient using a computer, they perceived e-learning systems as being easier to use. However, teacher self-efficacy and whether or not teachers perceive that using a particular e-learning system would be free of effort were the most important factors influencing teacher intention to use e-learning systems.

It has been stated that virtual classrooms can contribute to establishing students' personal learning environments, since these provide students with tools for editing and publishing content, and interact with peers. Ramos, Conde and Peñalvo (2014) found that among Ecuadorian college students the use of Web 2.0 tools such as GoogleDocs, Flickr, Wordpress, Blogger, Wikipedia, SlideShare, YouTube, Facebook, Twitter, Hi5, Skype, Messenger are very commonly used to find, edit, and publish content, as well as to share information, resources and reviews with others. Nevertheless, if these tools are not available students considered the virtual classroom as lacking sufficient resources and adequacy (Nagata et al., 2014).

Salinas et al. (2017), in their comparative study, found that level of adoption of ICTs in teaching in Ecuadorian teachers depends on their perceptions of self-efficacy using ICT, ICT's contribution to teaching and learning, and the training and knowledge teachers had access to.

Although the sample consisted of only in 37 teachers working in the public sector, their findings help to understand teachers perceptions about ICT inclusion in education and its usefulness. For instance, a high proportion of teachers described themselves as being able to use several ICT tools; however, they did not consider themselves able to integrate these into the curriculum. Additionally, they found that teachers ICT adoption was aligned with the ways in which the public policy emphasized and supported its implementation.

In regard to teachers' preparation, MINTEL's (2016a) national plan, in addition to providing internet connectivity and technological equipment to all public educational institutions in the country, also included the following objectives for teacher preparation: development of pedagogical practices with digital and innovative approaches to refresh current teaching-learning practices, and training in digital-pedagogical competencies for pre-service teachers and in-service training. The first objective was to develop specific guidelines for teacher training at the national level to guarantee progressive improvement in the quality of education, the teaching-learning processes, and the teaching profession. The purpose was to offer teachers training related to ICT innovative strategies, in order to allow teachers to achieve ICT competencies and further include them in their own planning and teaching. The development of these skills would be achieved through the development of technical instruments, methodological guides, and interactions among teachers to share educational experiences and to develop social skills (MINEDUC, 2018).

UNESCO proposed a model for ICT insertion in teacher training (Anderson, 2010). ICT insertion has to be gradual in order for technology to be efficiently integrated into the curriculum and therefore into the philosophy of each educational institution. This model has two dimensions: technology and pedagogy. The technology component is continuous and always increasing due to permanent advances, creation of new equipment, programs, and applications that are being developed daily. On the other hand, the pedagogy dimension represents changes and innovations in teaching practice and management. This dimension has four stages: 1) emerge, 2) apply, 3) integrate, and 4) transform (MINEDUC, 2018). It is expected that when teacher training programs had achieved the transformation stage, it would be the teachers who promote the best use and acquisition of equipment and require infrastructure updating to meet new curriculum requirements. In other words, teachers and teacher training institutions would use ICT as part of their professional and academic lives and as a result, educational institutions would become a center of learning for the entire community.

In Ecuador, however, inclusion of ICT in the teaching-learning process is carried out, also according to the 5 phases related to changes in the teaching career (MINEDUC, 2018). The phases are as follows: beginning in teaching, stabilization and consolidation, diversification - questioning, professional stabilization, and preparation for retirement. Table 8 displayed the relations between teaching professional career and ICT inclusion.

In order to achieve ICT inclusion, teachers have to either instruct themselves and/or take courses/ workshops, offered or endorsed by the Ministry of Education to meet the professional development requirement. MINEDUC's three options for professional development are as follows: 1) continuous training + techno-educational accompaniment, 2) initial teacher training, and 3) teacher professionalization.

Table 8. Relations between teaching professional career and ICT inclusion.

ICT inclusion phases	Teaching Professional career phases	Time (years of teaching career)	Observations
Emerge	Beginning	1 – 3	New teacher
Apply	Stabilization and consolidation.	4 – 5	Consolidation of routines, capacities and pedagogical-digital competences
Integrate	Stabilization and consolidation.	5 – 6	Consolidation of routines, capacities and pedagogical-digital competences
Transform	Diversification	7 – 25	Innovative phase
New teachers training at all levels	Professional stability	25 – 29	Ethical and / or practical tutors of ICT for new teachers
	Retirement preparation	30 +	

Source: Dirección Nacional de Tecnologías para la Educación. Ministerio de Educación

1. Continuous training + techno-educational accompaniment. Continuous training offered teachers permanent updates according to new technological developments in education and incorporate them in their pedagogical practice in order to improve the teaching and learning process as well as student achievement (MINEDUC, 2018). Additionally, techno-educational accompaniment was incorporated in order to strengthen pedagogical-digital competences. The main objective of the accompaniment is for teachers to conceiving lifelong learning as a fundamental part of the implementation of technology in education. Techno-educational accompaniment allows teachers to understand and assimilate ICT into their teaching first before integrating it into their teaching and using it with their students. Developing pedagogical-digital competences is necessary to improve the instruction process and to make the teaching-learning process more efficient (MINEDUC, 2018).

2. Initial teacher training. Public and private Higher Education Institutions jointly with the National Directorate of Technologies for Education of MINEDUC are responsible for identifying and developing pedagogical-digital competences to be developed in the teachers. Education careers curricula, nationwide, therefore, must be designed to meet these requirements. Teaching training programs must also contain methodologies for the pedagogical use of ICTs, which would guarantee the development of pedagogical-digital competences in future educators. In this way, the exit profile of the pre-service teachers would be standardized across all teachers educational institutions in the country.

3. Teacher professionalization. Teacher professionalization is a process in which teachers who have not completed their initial training can accumulate formal academic training which would lead to a professional degree in teaching. These types of programs are usually carried out under distance or blended modality and aim to provide teachers with the competencies to become promoters and facilitators of digital learning for their students. Higher education institutions are the ones responsible to offer teacher professionalization options and to coordinate the integration of ICT into teaching and learning processes at all levels of education (MINEDUC, 2018).

In terms of specific technical training offered to teachers, nowadays there exists only one course available to teachers through a Moodle server. The goal of this class is to present a Didactic model for flipped classroom[12]. Valdivieso and Gonzáles (2016), in their study about digital competence among elementary school teachers, found that the level of digital competence is low, but not null. With a sample of 420 public and private teachers from a southern district in Ecuador, the authors found that there is evidence of a trend towards curricular integration of ICT, especially, in teachers who are younger than 30 years old and for those who have graduated from endorsed pedagogical teaching institutes. Teachers reached high competence levels regarding the management of basic ICT issues, highlighting the use of Internet in teaching practice, especially for the

[12] https://fortalecimiento.educacion.gob.ec/

preparation of class content materials and for the instruction itself. On the other hand, teachers scored poorly in aspects regarding participation in learning communities and usage of Web 2.0 Tools (e.g., online software programs to teach curriculum content, store data, create/edit video, edit photos, collaborate). In the same way, teachers scored poorly concerning the use of ICT for school management or evaluation purposes, professional development, and ethical, legal and social aspects related to the appropriate use of ICT).

Nielsen and Budiu (2013) argued that teachers can understand and learn to use Web tools more easily through their mobile devices. Basantes, Naranjo, Gallegos and Benítez (2017) tested this theory by developing an app to support and strengthen computer science learning in an innovative, interactive, modern way through a mobile devices. Results showed that the majority of students and teachers felt motivated and comfortable using this didactic resource. It favored student participation in an active way, with a leading role to generate their own learning. In addition, students found the app very helpful for keeping track of content development and assignments. Similarly, teachers reported feeling communication with their students was more fluid and effective in responding to their concerns; in addition to saving time due to automatic grading online, simplifying their work. Teachers and students found the implementation of new technologies beneficial in several ways; however, they emphasized the need for more training for teachers and more technological strategies to facilitate ICT inclusion in the teaching-learning process. In addition to these factors, research has also identified other fundamentals influencing ICT inclusion at the college level. The frequency with which teachers use ICTs in class, types of ICT used, in addition to students and teachers' perceptions about use and need for training on the ICT. Murga, Quinde and Niama (2018) using data from 126 students and 18 instructors found that instructors almost never relied on the use of ICT´s whereas learners demanded their use on a daily basis since they considered that the use of ICT provided them with self-confidence to get involved with technology and enhanced the learning process. Teachers also reported a need for ICT training on the use of technology as they saw it helpful to improve teaching performance

Current deployments of platforms

Platforms in higher education institutions mainly rely on Moodle for deploying their e-learning environments. From a list of 43 universities, 38 have at least one server running an instance of Moodle for virtual and presential education. There exists other "well-known" LMS like Canvas, Blackboard, and self developed platforms, but less frequently. However, it is unknown how each institution is using the platform and if all potentiality of the tool is used, for example H5P content insertion, learning analytics modules, accessibility plug-ins, etc. A possible risk is having a platform but not being able to use it for more than to store static content.

In the context of learning platforms or environments aiming different groups of disadvantaged people, MINEDUC have deployed a e-learning platform for adults not having finished high school. Another target group include adults who have only finished basic education. Deployment use Moodle as LMS. The goal of the project is to use e-learning environments to broaden the number of students[13]. No data is available about the number of desertions. Nevertheless, Universidad del Azuay has been working on an accompaniment in ICT's for these kind of courses. Preliminar data shows future e-learning students would not be used to handle a computer or web browsing, which could hinder the success rate of the program only because a wrong handling of ICTs. Materials of the introduction course include files in format PDF and DOCX, links to videos, websites or lessons packaged in SCORM format, queries or questionnaires, and task's deliveries.

Recommendations for SELI Project

It is now, that technologies are being used in the society and economic growth, and this is also transforming ways of working, studying, communicating, accessing information, or spending leisure time. Internet and especially social technologies are being used for various purposes by different groups of citizens, and are also being appropriated for new social activities. The digital literacy gap is framed not just in terms of access to computers and the internet but also by the effective use of a range of media and communications platforms and services (Bawden, 2008; Martin, 2006). Nevertheless, along with tool usage skills, people need to have the motivation and the competence to strategically and innovatively apply these tools in different work and life contexts, for their own benefit, and that of their community, the economy, the political, cultural, and the environment. Therefore, it is crucial for Ecuadorian policy makers, stakeholders, and citizens, to start incorporating those digital capacities in the assessment of digital literacy in society. It would also help to reduce social disparities not only currently but also for future generations. Children from highly connected families encounter fewer barriers to full participation in the economy than their more digitally disadvantaged peers from less connected families (Robinson et al., 2015). It can be argued that the economic stratification order is already undergoing significant transformations relating to existing and emerging digital disparities.

From our analysis, it is evident that the digital gap is still present in both the society and the school. It is therefore recommended to establish and support strategies like the ones presented by SELI project. The importance of developing and adopting technological and pedagogical strategies as a resource to strengthen ICT inclusion and reducing digital illiteracy is given by all the benefits their implementation would bring to Ecuadorian society as a whole. It is important to point out that the development of learning environments for ICT inclusion should consider crucial aspects in their design. First,

[13] see adistancia.educacion.gob.ec

analysis of key factors such as the characteristics of the environment in which the learners work and subject of study should be included, and contextual, pedagogical, technologica, and content aspects of each country have to be identified. Second, the instructional design of the learning environment should enable the planning, preparation, and design of resources, activities and ambience of spaces in order that, who learns, achieve the necessary knowledge during the training process (Belloch, 2013). Finally, free and systematic access to the learning environment has to be guaranteed for all users. It also needs to ease access and navigation. SELI learning environments provide us with such opportunity.

SELI learning environment could therefore be particularly useful to reduce digital exclusion and to present Ecuadorian society with strategies that could be used not only by people from underrepresented groups, but also by students, pre-service, and in-service teachers who would like to develop or increase their digital competencies; especially because the strategies presented in SELI learning environment account for a diverse level of digital competence among users. SELI strategies along with the plans and actions adopted by the government could provide the best opportunity to reduce digital literacy gap in both education and as a consequence, the society.

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ICT FOR LEARNING AND INCLUSION IN FINLAND

Abstract: This chapter presents the current trends, conditions and opportunities available regarding the application of information and communication technology (ICT) in teaching and learning process across Finland. The chapter also present information about ICT use in Finland, the level of digital literacy and the focus of how the teachers use ICT in Finland. In addition, this work outlined the roles that ICT played to support the inclusion of disadvantaged people in the educational system in Finland, the special place of the continuous professional development among teachers in Finland and recent technologies that seeks to bring innovation to the Finnish classroom, such as the Blockchain technology.

Keywords: Information and Communication Technology, Finnish teacher, Inclusion, Finland, Global sharing pedagogy, Blockchain technology

ICT in education general information about Finland

Information and Communication Technology (ICT) has tremendously revolutionized the field of education with a huge impact and obvious effect on teaching and learning process. The use of ICT in teaching and learning in Finland is steered through education policy, which is formed by several stakeholders, public and private (e.g. Opetushallitus 2018; Ministry of Education and Culture 2016). In the beginning of the 2000's Internet and network connections had settled as a part of Finnish everyday life. Finnish Ministry of Education and Culture supported several national projects to help Finnish education to take ICT as a part of working culture. Internationally Finland was not among the top 12 countries in ICT use in education, which provoked a national concern. In 2003 the Finnish Government Program outlined a goal that every student in basic education should have a personal computational device as a central learning tool in school. The goal was not achieved, because it confused education specialists and local municipalities were financially in unequal positions to each other and ICT had not been widely used daily in schools (Jantunen, 2019). Teachers' skills were not an issue at the time (Niemi et al. 2014). The Finnish Ministry of Transport and Communications, in collaboration with Ministry of Education and Culture, Finnish National Agency for Education, schools and other stakeholders, set an advisory board to compile a national strategy of adopting ICT as apart of school's everyday life. It was made public in 2010. The focus was to respond to the need for strong pedagogical models, shift in school culture and pedagogical expertise (Jantunen, 2019).

Table 1 present information about ICT use by people in Finland. Table 1 indicates that most adult (89%) population in Finland engaged in the use of different ICTs to access the internet. Parra (2012) claimed that school is one of the venues where technology has had the greatest impact, which in turn has had an effect on the role of the teacher and become a part of the school everyday life. According to Aguilar (2012), ICT have become educational tools that could further improve the educational quality of the student and revolutionize the way information is obtained, managed, and interpreted. Various technological devices are used in and outside the classroom settings to support the teaching and learning process (Oyelere & Suhonen, 2016). These devices include mobile phones, iPads, laptops, tablets, wearable, and phablets. The device to be used at a particular time depends on the lesson, method of teaching, and the educator in charge of the class. Tablets and laptops can enable the use of eBooks, and are sometimes essential to maintaining accessibility standards. Several previous studies, Niemi and Nevgi (2014); Kalaojaa and Pietarinen (2009); and Oyelere, et al. (2018), indicate improvements to active learning and student engagement with content through ICT, especially when that use was continued outside the classroom. While the use of electronic devices has a lot of impact, its use in class can lead to a distracting learning

environment, as study by Ravizza et al. (2016) found that students who used laptops in class for non-academic reasons had poorer class performance.

Table 1. Use of information and communications technology by individuals in Finland

	2013	2014	2015	2016	2017	2018
	% of population aged 16 to 89					
Internet users	85	86	86	88	88	89
Uses the Internet several times per day	61	64	67	72	73	76
Smartphone in own use	56	63	69	72	77	80
Made online purchases	44	48	45	44	52	47

Source: Official Statistics of Finland (OSF): Use of information and communications technology by individuals [e-publication]. ISSN=2341-8710. Helsinki: Statistics Finland [referred: 4.5.2019]. Access method: http://www.stat.fi/til/sutivi/index_en.html

Level of digital literacy in socjety

The shift towards a technologically savvy workforce has permeated the classroom which brings about digital literacy. Digital literacy is defined as the ability to effectively find, evaluate, create and communicate information using a range of digital technologies. According to Levy, (2018), it makes sense to assume that the more digitally literate our teachers are, the more they will employ these skills in the classroom, which will in turn foster a strong sense of digital citizenship in our students. A digital literate teacher will be imaginative teachers. They create a classroom culture of creativity and reflection. They think beyond the classroom in terms of how to make lessons meaningful, and in so doing, might see a need elsewhere in school that their innovation can address (Heather, 2015). With its high levels of educational achievement and attainment, Finland is regarded as one of the world's most literate societies. More than 98 percent attend pre-school classes; 99 percent complete compulsory basic education; and 94 percent of those who start the academic strand of upper secondary school graduate. Completion rates in vocational upper secondary school also reach close to 90 percent (Statistics Finland, 2010; Välijärvi & Sahlberg, 2008).

Table 2. Prevalence of equipment and connections in households in Finland [1]

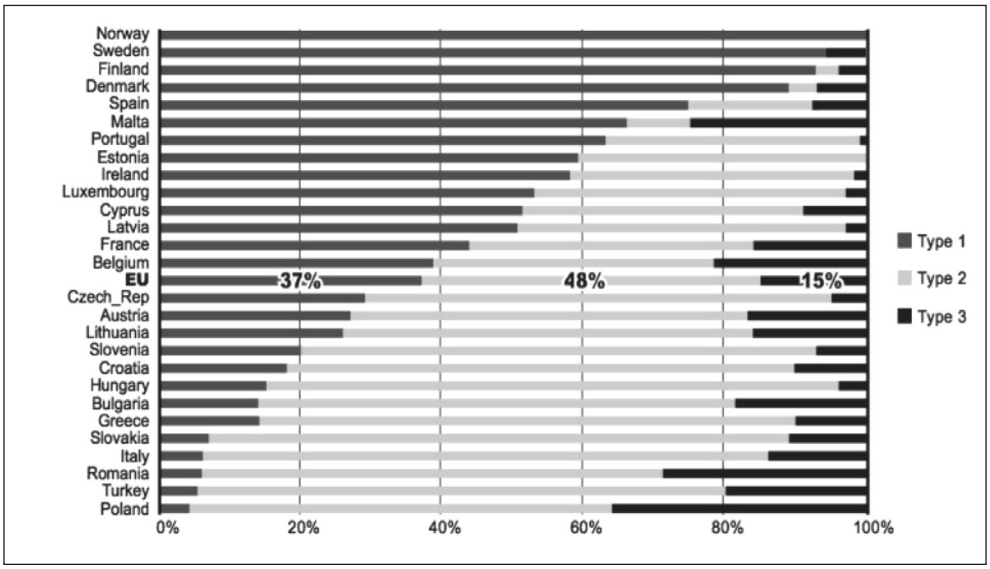
	2013	2014	2015	2016	2017	2018
	% of households					
Flat screen TV	76	81	85	86	87	87
Full HD TV	41	49	53	58	59	62
Smart TV	. .	19	24	30	34	. .
TV pay card	26	26	25	22	21	20
IPTV	12	14	17	20	22	25
Home theatre	24	22	22	22	19	19
Digital camera [2]	67	63	60	56	50	47
Camera copter	. .	. .	. .	2	2	. .
PC	90	90	90	91	90	91
Laptop	77	78	78	79	79	81
Tablet	22	39	51	56	59	61
Printer or scanner	60	60	61	58	60	58
Mobile broadband	53	57	67	68	72	73
Wireless Local Area Network (WLAN)	50	54	62	66	68	70
Wearable smart device	. .	5	13	18	22	. .
Landline telephone (subscription)	14	12	9	9	7	6
Smartphone	60	69	76	82	87	90
GPS tracking device in car	31	35	32	32	30	31

1) The age of the household target person is between 15 and 74
2) Including digital video camera

Source: Official Statistics of Finland (OSF): Consumer survey [e-publication]. ISSN=1799-1382. Helsinki: Statistics Finland [referred: 4.5.2019]. Access method: http://www.stat.fi/til/kbar/index_en.html

According to Statistics Finland, comprehensive schools had 560,500 pupils in 2018. The number of pupils in comprehensive schools increased by 0.7 per cent from the year before. Forty-nine per cent of the pupils in comprehensive schools were girls and 51 per cent were boys (http://www.stat.fi/til/pop/index_en.html). Survey of Schools, ICT in Education (EC, 2013) shows the Finnish schools' overall ICT infrastructure (see figure 1) is one of the best in Europe.

Figure 1. Percentages of students by school type in terms of equipment (Grade 4, country and EU level, 2011-12)



Source: Jaakkola (2013); European Commission, 2013.

At grade 8, the EU average 38, as seen in fig. 1.13b, is 24% of students are in type 1 schools – considerably fewer than at other levels – and 68% in type 2 and 8% in type 3. In only the four Scandinavian countries are more than one in two students in a type 1 school.

How teachers use ICT in Finland

The term ICT could be viewed as the tools and technologies used to gather, share, analyze, store, and transmit information. ICT has been a major vehicle to promote educational, socio-economic and human development, as it has an overwhelming impact in our educational, social, economic, political, cultural life. In education sector, in all over the world ICT has made it more frequent to achieve the knowledge because the quality learning equipment are Retrieved from web at a bigger range nowadays. In developed countries, like Finland, ICT in education is one of the most important focus points to come up with a quality, convenient, and proper educational or learning environment. Efforts to promotes professional competences of student teacher for enhanced teaching in Finland is ongoing. For example, Virtanen, et al. (2017) conducted a study to identify the relationships between active learning, student teachers' self-regulated learning and professional competences. Their study showed the importance of the regular use of active learning methods for ensuring student teachers' professional development. In addition, the findings confirm that self-regulated learning (SRL) is crucial for student teachers to engage in lifelong professional development and they should be encouraged and guided towards SRL to master the most demanding professional competences.

Finland is one of the most highly technological countries because of its excellent technical infrastructure, socio-economic, educational development from preliminary to higher studies (Jamrisko and Lu, 2017) . Finnish education system has become one of the most successful and famous within the whole world during the last decade. Teachers have been played a major role for succeeding in the area of education and development by using or implementing ICT.

ICT is being conducted to studies due to some direct and indirect benefits and supports to learning. In direct support, it should be more efficient, active, independent, development of team work, citizenship skills, development of communication and other ICT skills are the common reasons of pedagogical use of ICT. In indirect support, teachers' development, educators' encouragement, assessment service improvement, employment opportunities and also some social and community purposes (Wikström 2011). To make a bridge between the learners, pupils and digital tools in schools in learning settings, teachers are obviously the key persons.

Based on some existing studies ICT is used to teachers in different types of perspective such as, learning point of view, motivational point of view, and innovation. In learning perspective, they use ICT for supporting and helping students' learning for development and growth in competences to reach their study goals. Some factors including activity and intention, interaction and collaboration, self-evaluation and reflection, contextualization are highly focused to set and ensure the individual learner's development in learning settings. These factors are considered most to influence students to be more interactive, systematic in their studies in a supportive manner where the ICT skills are quite similar or related to each other from low-level to high-level ICT skills. The concept of motivational aspects in learning and teaching is based on some other factors including self-determination, situational interest, and capability to control over mind. The closer analysis belongs to motivate or for increasing students' interest in learning. To ensure more engagement teachers support to create interest, enjoyment, social relatedness, feeling of effectiveness, co-planning, and collaboration to students through ICT (Meisalo, et al. 2010). The percentage users of ICT equipment while teaching was not too much in some early stages in Finland (Jaakkola, 2013). Finnish teachers in schools used ICT to make or prepare the lessons but did not use during lectures. Day by day, it is increasing, and the use of ICT equipment is much in higher-level studies or university level. Teachers use smart tools and devices like personal computer, laptop, mobile phone, tablet, smart board, projectors and so on, during their teaching sessions, which make the study environment more convenient and inclusive for both of the students and teachers.

There are many ICT associated technologies and online environments used by the teachers. Flipped classroom technology, Massive Online Open Courses (MOOCs), virtual classroom, distance learning, social media platforms, game-based platforms, and other online learning platform such as moodle, weboodi, slack, google classroom etc.

are commonly used in various situations and study purposes in Finland. For example, the case of flipped learning at the University of Eastern Finland (https://www.uef.fi/en/web/ameba/research/flippedclassroom), in which team of researchers are researching the use and experiences of flipped classroom teaching and learning to further develop learning environments, teaching, and learning in higher education. Teachers provide the study materials in some pre-recorded video format, online pages, or other relevant sources to the students beforehand so that the students can get an overview of the lecture materials through their online environment and personal device before the lecture period. Then in classroom teacher focuses on practical matters, exercises, and collaborative discussion about those particular topics within students. By this way the study results as a more effective and inclusive system to learn. In distance learning or in case of some special classes, seminars, and conferences, teachers use online streaming software or video conference tools for supporting students to join via online so that anybody who is physically unable to be present at that classroom do not miss the chance to join at that session from distance. An example of the online study programme is the IMPDET-LE (International Multidisciplinary PhD Studies in Educational Technology & Learning Environments), which is an online doctoral training programme run by the University of Eastern Finland (http://impdet.org/). The IMPDET-LE programme follows a blended learning approach, which means that the studies can be completed online. However, the doctoral candidates of the programme are highly encouraged to spend some periods in Joensuu Campus of the university in order to receive intensive supervision or to collaborate with the research community and peer students. The online classroom and MOOCs are also providing opportunities to study online. The idea is to make the learning environment global and easier for all of the learners and teachers. Along with the use of digital tools and applications, the level of digital literacy has to be ensured for users especially for the teachers so that they can provide quality teaching to teeming learners. However, it is not always so easy to implement ICT successfully in all educational perspective but there is a significant standard in Finland.

Massive Open Online Courses (MOOCs) – the Finnish case study

Only a handful of university in Finland offers MOOCs. The list of institutions and the courses offered by each university is presented in Table 1.

Table 3. Finnish universities offering MOOC courses

Institution	MOOC courses	Website address
University of Helsinki	1. Introduction to AI 2. Building AI 3. Cyber security base 4. Object-oriented programming I 5. Object-oriented programming II 6. DevOps with Docker	mooc.fi
Aalto University	1. Programming Scala 2. Matrix Calculation 3. Code ABC 4. Advanced programming	mooc.aalto.fi
Haaga-Helia University of Applied Sciences	1. Business ICT Skills 2. Entrepreneurship 3. Business Mathematics	mooc.haaga-helia.fi
University of Jyväskylä	1. Education in Finland – why are Finnish schools so successful? 2. Early childhood education in Finland: What, where and how? 3. The success story behind Finnish basic education. 4. Educational support and guidance services in Finland	https://www.avoin.jyu.fi/en/studies-offered/moocs

Case study: In spring 2018, a collaboration ensued between Reaktor and the University of Helsinki to empower people to understand artificial intelligence (AI) through MOOCs. Two courses are now being offered through this joint effort with over 142,000 students across 110 countries and 40% women participating in the MOOCs courses. The courses offered are Introduction to AI and Building AI. The goal of this popular Finnish AI course is to reach one percent of the world's population - 77 million people (https://www.elementsofai.com/).

ICT for Disadvantaged People in Finland and Universal Instructional Design

The method and approach for teaching and learning have been a topical issue and widely discussed in the research domain. More specific attention is given to the disadvantaged learners in the aspect of how to ensure students of different disadvantaged groups have a better education in a convenient form. The use of information and communication technology (ICT) have played key role towards providing innovative design for education of the disadvantaged people. According to Kozma and Wagner (n.d. pp.4) "cognitive and social research and theory provide a number of insights into how programmes and policies can address the needs of the most disadvantaged students". ICT can provide significant added value to these programmes and policies, if used appropriately.

There are several technologies to assist physically disabled people such as adaptive technology, assistive technology, and web technology among others. Digital assistive technologies are particularly helpful for sensory or cognitive disabilities. Text-to-speech is one highly utilized digital assistive technology which has assisted many people with cognitive disabilities so far. Another one is spell-checker which has proved to support young people with dyslexia. Some remarkable achievements have been observed with screen-reading software, which help blind people understand the context and gain knowledge. Wearable technologies such as Dot is a Braille smartwatch which help blind access message, tweets and books. Finger Reader is another wearable technology which help visually impaired people read text. To assist people with mobility impairment, sip-and-puff system has been beneficial which enables student to utilize computer and mobile device using their mouth. For students with hearing impairment, FM system and Infrared audio induction loop system have been supporting them listen and understand the teaching as other students. In order to help disabled people to interact with computer, alternative input devices are also introduced such as head pointers, foot operated mice, motion or eye tracking and single switch entry device. Apart from that W3C had carried out Web Accessibility Initiative (WAI) which develops strategies, guideline and resources in order to help disable people access and interact with the web which proved to be an important step towards inclusion for disabled students.

In Finland, one of the basic principles of education is that all people must have equal access to high-quality education and training. The same educational opportunities is available to all citizens irrespective of their ethnic origin, age, wealth or where they live. For Finland government, the ideology is to provide special needs education primarily in mainstream education. All pupils of compulsory school age have the right to general support, that is, high-quality education as well as guidance and support. Intensified support are given to those pupils who need regular support measures or several forms of support at the same time (the disadvantaged). The aim is to prevent existing problems from becoming more serious.

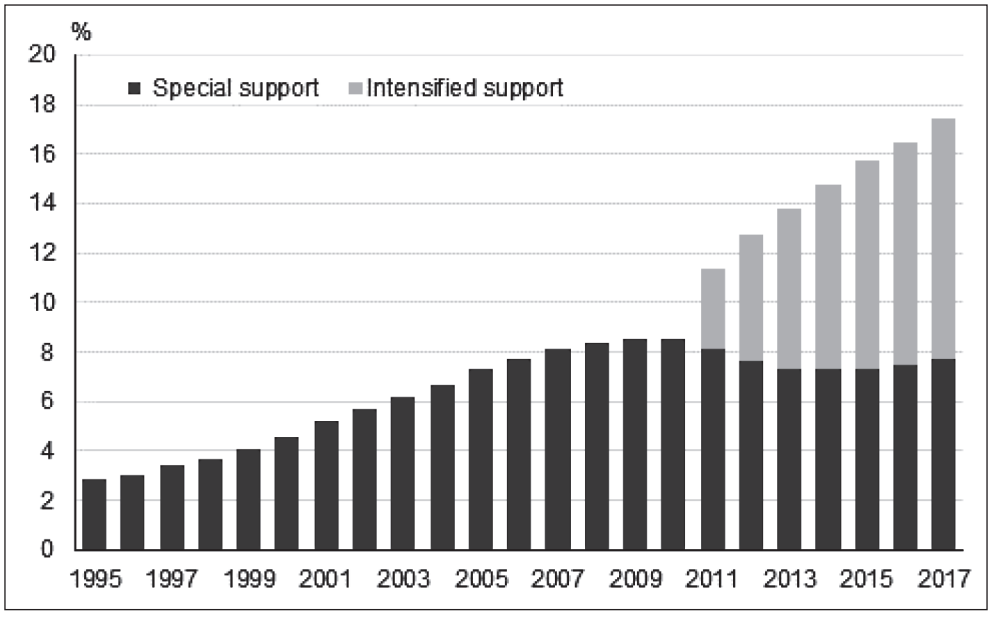
In a situation where students cannot adequately cope with mainstream education in spite of general or intensified form of support, they are given special support. The main purpose of special support is to provide pupils with broadly based and systematic help so that they can complete compulsory education and be eligible for upper secondary education. Special needs support is also provided in upper secondary education. In vocational education and training, students in need of special needs education are provided with an individual education plan. This plan must for example, set out details of the qualification to be completed, the requirements observed and support measures provided for the student (Ministry of Education and Culture, 2017).

In a more concise form, Jaakkola (2013), at center for learning researcher, University of Turku presented an overview of Finnish education regarding the disadvantaged people.

I. Extra care is taken about weaker students;
II. 30 percent of children receive extra help during their first nine years of school.
III. There are also schools for special needs children and children with more severe learning difficulties.
IV. 93 percent of Finns graduate from high school.
V. 66 percent of students go to college - the highest rate in Europe
VI. For many years, Finnish students have been on the top or very close to the top for science, reading and mathematics in international standardized comparisons (e.g. PISA and TIMMS)

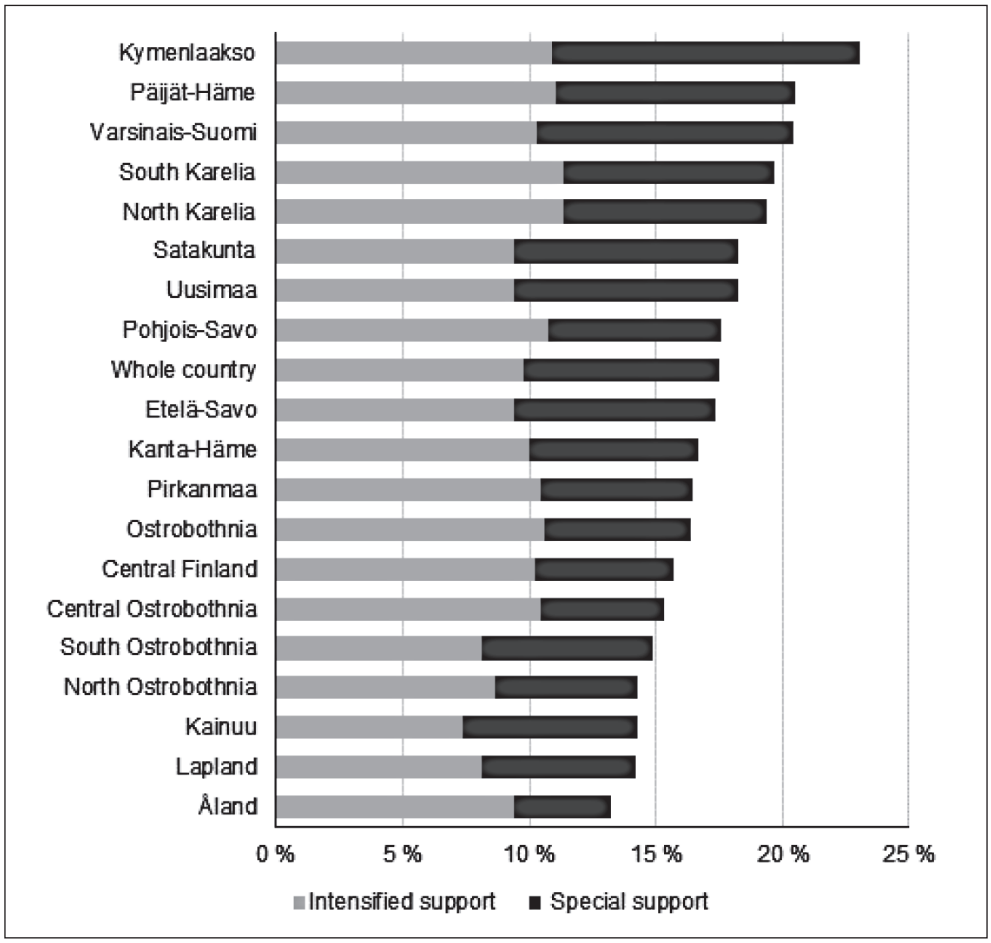
In Finland, progressively more comprehensive school pupils received intensified or special support. Figure 1 shows the share of comprehensive school pupils having received intensified or special support among all comprehensive school pupils between 1995–2017 in Finland. Figure 2 indicate the share of comprehensive school pupils that received intensified or special support by region in 2017.

Figure 2. share of comprehensive school pupils having received intensified or special support among all comprehensive school pupils between 1995-2017 in Finland.



Source: Official Statistics of Finland (OSF): Special education [e-publication]. ISSN=1799-1617. 2017. Helsinki: Statistics Finland [referred: 4.5.2019]. Access method: http://www.stat.fi/til/erop/2017/erop_2017_2018-06-11_tie_001_en.html

Figure 3. Finland's share of comprehensive school pupils having received intensified or special support by region 2017.



Source: Official Statistics of Finland (OSF): Special education [e-publication]. ISSN=1799-1617. 2017. Helsinki: Statistics Finland [referred: 4.5.2019]. Access method: http://www.stat.fi/til/erop/2017/erop_2017_2018-06-11_tie_001_en.html

Special solutions dedicated to people with some disabilities

Over the years, Finland has focused on supporting programmes, processes, and systems that build the human capacities. As reported by the Ministry of Foreign Affairs, the country, since 2013 has supported the strengthening protection of persons with disabilities in forced displacement. The information in Table 1 briefly describes the "four central categories of technologies used in special education in Finland" while and Table 2 presents the four approaches of using technology in special education (Karna-lin et al., 2007). The description these technologies is based on four approaches, which serves as overview of frameworks that have been used as Technologies for Children with Individual Needs (TCIN).

Table 4. Summarized table of the approaches to using technologies for education of the disadvantaged people.

Aspect	Technology	Examples
Hearing, seeing, communication, movement, study, and play	Assistive technology	Wearable technology, Voice Recognition Software and Free/ Built-in Speech to Text Options, Google Chrome Apps & Extensions (GAFE), Free Text-To-Speech Options
Speaking, reading and writing	Communication Devices	Augmentative and Alternative Communication (AAC)
Language Vocabulary, Problem Solving	Learning software	Lexia, Dyslex, Cami,
Construction set, programmable building blocks	Educational Robotics	LEGO, ELEKIT, SonyAibo, Vex Robotics

Table 5. The four approaches of using technology in special education.

Technology	Main target group (1,2,3)	Main target group (1,2,3)	School Level (C,G,V)	Tools	Subjects
Assistive technology	1,2	P, C	C, G, V	Examples: walking stick,special keyboard and mouse	Any school subject
Communication devices	1,2	P, E, C	C, G, V	PCS-symbols, pictogram, and Bliss symbols	Any school subject that requires, e.g., reading, writing, and talking
Learning software	2,3	C, S, E	C, G, V	Lexia, Dyslex, Cami	Any school subject that requires, e.g., reading, writing, mathematics, perception
Concretizing technologies	2,3	C, S, E	C, G, V	Educational robotics, e.g., programmable LEGOs and VEX robots	Especially science and technical subjects

Abbreviations:

Main target group (see Section 1): 1 =severe disabilities, 2 =less serious disabilities, 3 =students with occasional special needs.

Disability addressed: P =physical, C =cognitive, S =social, E =emotional.

School level: C =comprehensive, G =general upper secondary, V =vocational upper secondary

Some research results about e-learning platforms in Finland

The Global Education Park (GEP) Finland outlines some innovations for digital learning and education. Table 3 shows a few selected examples of such innovative platforms for learning according to EDUPark.

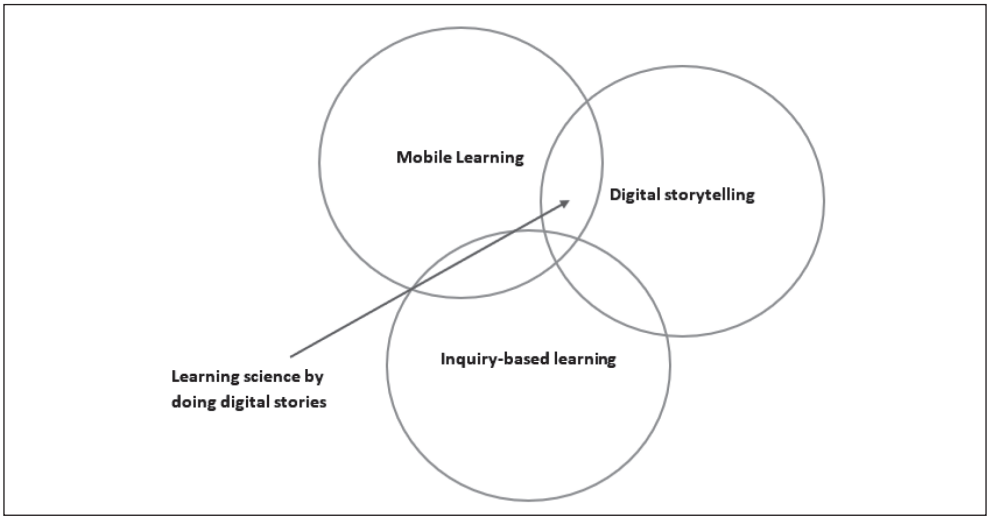
Table 6. Examples of e-learning platforms according to Edupark Finland

Valamis	Valamis learning platform offers organisations a solution that transforms the challenges posed by digitalisation into a competitive edge. Designed for companies and large organisations, Valamis is a learning platform that facilitates learning and the availability of information regardless of time, place or hardware. The Valamis learning platform encourages social learning and is suitable for use with, for example, personnel training, sharing information and verifying compliance.
ArboEdu	ArboEdu is a digital support for pedagogical work, taking pupils to learn out of the classroom. With the easy-to-use application, teachers can create custom made tasks and learning routes outdoors. With the help of a mobile device, pupils can then navigate from task to task, solving them in a stimulating environment. ArboEdu enables the teachers to implement part of the teaching out of the ordinary study environment and activating pupils without losing valuable time from learning the subject on hand. ArboEdu can be used in primary schools, as well as in secondary- and upper secondary schools. Use of the application is not limited only to some specific subjects, as any can be integrated to tasks in the application.
Keeduu	Keeduu is an electronic learning environment, which combines educational content, instructional and learning tools, and gaming. Keeduu pedagogy offers a new way of using mobile devices by combining games and learning materials in a suitable way. In Keeduu, textbook content, videos, interactive assignments, educational exercises and a game form an entity designed to support pupils' inner motivation. Keeduu takes learning outside the classroom and supports functionality in learning. Keeduu can be customised for each curriculum by a team of developers. Keeduu is based in Finnish excellence of learning and supports cognitive learning and the flipped classroom method.
Epic Challenge	Epic Challenge teaches students NASA's innovation skills. Using new digital technologies, students work in teams to solve some of the toughest challenges facing humanity. The programme is a synthesis of practical engineering experience at NASA and top innovation research results. In 2009, the programme was expanded to include undergraduates and high school students. It was found that the Epic Challenge programme could encourage younger students to study STEM (Science, Technology, Engineering and Mathematics) subjects and pursue careers in STEM. In 2015, Finnish digital learning platform company Valamis began collaborating with Epic Challenge founder, Dr. Charles Camarda. These days, the University of Eastern Finland, Karelia University of Applied Sciences and Riveria has all joint the program, in the region of Joensuu. The challenges are defined in co-operation with local R&D and industry partners. During the course, students test their ideas extensively in various kinds of self-designed experiments, thus improving their ideas dramatically during the course. In Joensuu, the programme seems to have had an enormous impact on students' entrepreneurial aspirations. In the pilot year alone, more than half of the students launched their own product development project during or after the course.
ENO Environment Online	Founded in 2000, Environment Online – ENO is a global virtual school and network for sustainable development based on activity-based learning. Pupils at the school study environmental themes, share information and highlight current environmental issues in their own vicinity. ENO is also part of the Green Cities network, which includes 50 cities in 23 countries. Nearly 10,000 schools from 157 countries have participated. The standard themes of ENO are: climate change, forests, consumption and culture. ENO places an emphasis on student-centered working methods and active citizenship, making use of information and communication technology. The most concrete environmental action taken is the planting of trees. ENO's "Tree Planting Day" has been held on the UN's International Day of Peace (21 September) every year since 2004. ENO's goal is to plant 100 million trees by 2017, when Finland celebrates its centenary. ENO works in co-operation with the University of Eastern Finland and United Nations Environment Programme (UNEP). Member institutions of the UNESCO Associated Schools Network actively participate in ENO campaigns. Materials produced by ENO students are also used in learning materials intended for use by the UN. ENO is a world-renowned Finnish educational innovation and has received numerous awards in Finland and abroad.

Some technical and pedagogical tips

Tips for new pedagogical approach to teaching and learning was revealed through an experiment by combining three aspects of learning; inquiry-based learning, mobile learning, and digital storytelling Hannele et al. (2014). The pedagogical concept is called learning science by doing digital stories (see figure 1). The inquiry based learning emphasis on the principles of an authentic scientific investigation and widely used in the field of sciences. Mobile learning utilizes mobile devices, for example, smartphones and tablets (Kearney et at., 2012). The rapidly evolving use of mobile devices for learning triggered a pedagogical approach that allows learners to learn from anywhere. As an enhanced e-learning, the informal and flexible aspect of mobile learning broke the barrier of classroom boundaries where time and place of learning are usually dictated. Digital storytelling on the other hand compliment the earlier two approaches discussed by attempting to divide stories into three categories: personal narratives, instructive or informing stories, and stories of historical events.

Figure 4. Learning Science by doing digital story



Source: Hannele et al. (2014)

Innovative solutions driven by ICT in Finland

The innovative solutions used in Finland by teachers are developed in partnership between the EdTech companies and the teachers, who possess both long working experience and higher university degree. Example of some innovative solutions developed for Finnish education as reported by Niemi et al. (2014) and Finnish ETtech Sector (Finnpartnership) are presented in Table 3.

Table 7. Examples of innovative solutions developed for Finnish education

Solution	Description	Link
Paths to Math	Paths to Math is an innovative, challenging and student-centered method to teach and learn mathematics for lower-secondary and middle school students. The founder of Paths to Math, Maarit Rossi, worked for decades as a teacher of mathematics. She was among the top 10 finalists of the Global Teacher Prize 2016. She created the Math Learning Environment because she was worried about students' decreasing interest in mathematics. She wanted to implement modern pedagogies, such as learning by doing and learning by thinking, learning to solve problems and learning to apply theories to real-life problems.	pathstomath.com
SkillzzUp	SkillzzUp is a software, which allows to assess and follow individual skill development in real time at any educational level. It provides constant information about the student's learning progress for the teachers, the student him/herself and parents. The founder and CEO of SkillzzUp, Kimmo Kumpulainen, worked as a teacher for more than 13 years. While working, he noticed that many young students and pupils are unmotivated by the traditional theoretical lessons, exercises and exams provided by teachers today. Kimmo wanted to teach his students in a more personalized way and pace. As he couldn't find any existing tools or solutions on the edutech market to solve this common problem, he decided to create one of his own	skillzzup.com
Seppo	Seppo in an innovative tool for creating educational games. It can be used on all educational levels from pre-school to university. It was developed by a history teacher, Riku Alkio, for 20 years. Alkio wanted to take learning from inside the classroom to the outside world, such as to city centers and parks during field trips. The basic idea is that teachers create game tasks, which students then solve in teams by using mobile devices. The map of the selected area works as a game board. During the game teacher monitors the game, assesses the answers submitted by the teams and gives feedback	seppo.io/en
Kindiedays	Kindiedays is an application in which educators and families collaborate in real-time on all the matters related to the education and wellbeing of the child in the childcare center. The application was designed by a kindergarten teacher who was thinking could it be possible to communicate with parents during the day and let the parents know that their children are safe and sound. Parents are also hoping to know more about how their kids are spending their time in the kindergarten. This application provides a tool to capture the children's activities and learning with pictures, videos and notes	kindiedays.com
Claned	Claned is a collaborative online learning platform that supports an individual to learn better real-time. Claned personalises learning to each individual improving their study motivation and learning results. This is possible by combining artificial intelligence, machine learning and Finnish pedagogy revealing what factors impact individual learning. In Claned, students can build their own individualised learning paths, track their progress, collaborate with peers, act and adjust learning habits	claned.com
GraphoGame	A mobile game, which aims to teach the very basic language skills that are crucial for learning to read. GraphoGame is an early literacy game designed in co-operation with academics from universities around the world, leading university being the University of Jyväskylä, Finland, and professor Heikki Lyytinen. The game is based on the scientific follow-up study of Finnish children, which began already in the early 1990s. The game is widely used in kindergartens in Finland. Different language versions have been developed and tested during the years. Currently, the GraphoGame is been commercialized as the University of Jyväskylä and Niilo Mäki institute made a deal with Learning Intelligence Group Ltd to launch a new enterprise around the solution	graphogame.com

Education of educators of disadvantaged groups in Finland

Over the years, the global ranking of the Finnish educational system has remained high. This trend is notably ever since the Organisation for Economic Co-operation and Development (OECD) issued the results of the 2001 evaluation of its well-known Programme for International Student Development (PISA). Finnish education system, which has remained high ranked (see Table 1, PISA results of 2000 - 2015), has received tremendous attention across the globe not only about its various levels of education, curriculum, policies, but also about the training of teachers (Kansanen, 2015; OECD, 2011).

Table 8. Finland's mean scores on reading, mathematics and science scales in PISA

	PISA 2000	PISA 2003	PISA 2006	PISA 2009	PISA 2012	PISA 2015
	Mean score	Mean score	Mean score	Mean score	Mean score	Mean score
Reading	546	543	547	536	524	526
Mathematics		544	548	541	519	511
Science			563	554	545	531

Source: OECD (2019), PISA 2000 - 2015 Results (https://www.oecd.org/pisa/).

One important reason for the continuous success and excellent ranking of the Finnish educational system is the training of the teachers and professional skills acquired through experience by the teachers in Finland. The professionalism of the teachers is made through a research-based teacher training and reinforced by practical teaching experience as a preservice teacher in the school site. Finnish culture and society considers education highly, and education is deeply rooted in every sphere of the society. This is also extended to the teachers, as they are independent, appreciated, respected and trusted. In Finland, teaching is regarded a noble, prestigious, and admired profession, which is motivated based on ethical and honorable resolve but not material gains (Sahlberg, 2010). Besides, the Finnish education system, which allows the children to start primary school at the age of seven, go a long way to ensure the success of education of every individual in the society. Table 2 provides the population in Finland by level of education in 2017, Table 3 presents the students and qualifications attained in Finland in 2017, and Figure 1 presents the transition of graduates to employment one year after graduation in Finland in 2017.

Table 9. Population by level of education in Finland, 2017

	Total	%	Females	%
Population aged 15 or over	4,622,706	100	2,358,607	100
Population with educational qualification, total	3,334,648	72.1	1,726,666	73.2
Upper secondary education	1,863,943	40.3	885,689	37.6
Post-secondary non-tertiary education	38,429	0.8	17,929	0.8
Lowest level tertiary education	436,426	9.4	268,435	11.4
Lower tertiary level	518,969	11.2	292,374	12.4
Higher tertiary level	431,146	9.3	241,915	10.3
Doctorate level	45,735	1.0	20,324	0.9
Only basic education	1,288,058	27.9	631,941	26.8

Source: Official Statistics of Finland (OSF): Educational structure of population [e-publication]. ISSN=2242-2919. Helsinki: Statistics Finland [referred: 4.5.2019]. Access method: http://www.stat.fi/til/vkour/index_en.html

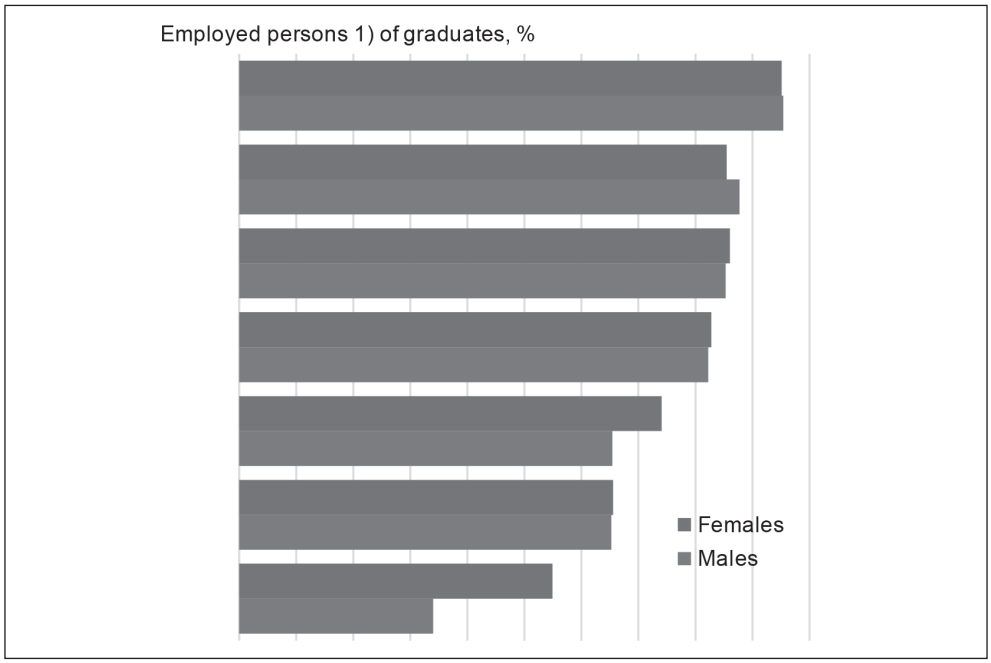
Table 10. Students and qualifications attained, 2017

Sector of education	Students [1)]	Qualifications attained
Basic comprehensive school education, compulsory education school	556,742	57,609
Basic education of adults	4,160	838
Upper secondary general school education	103,753	30,641
Vocational education	326,952	76,831
University of applied sciences education	141,254	26,304
University education	153,262	31,014
Total	1,286,123	223,237

1) Students in education leading to qualifications. The data for vocational education relate to a calendar year. The data for other educational sectors describe the situation on 20 September.

Source: Official Statistics of Finland (OSF): Educational structure of population [e-publication]. ISSN=2242-2919. Helsinki: Statistics Finland [referred: 4.5.2019]. Access method: http://www.stat.fi/til/vkour/index_en.html

Figure 5. Employment of graduates one year after graduation in Finland, 2017

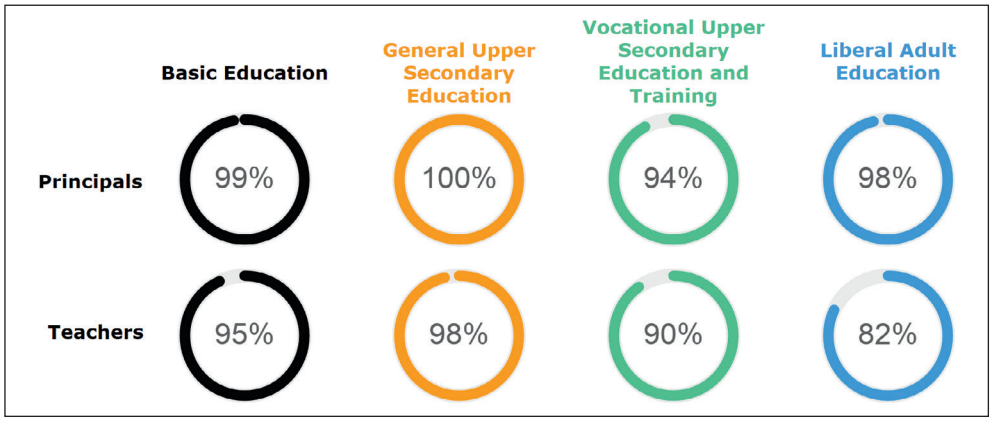


Source: Official Statistics of Finland (OSF): Educational structure of population [e-publication]. ISSN=2242-2919. Helsinki: Statistics Finland [referred: 4.5.2019]. Access method: http://www.stat.fi/til/vkour/index_en.html

University and another curricula to pre-service teachers according to ICT

Teachers in Finland are exceedingly trained professionals (see Figure 2, qualified teachers by level of education in Finland in 2015). At the general education level, the minimum requirement to teach is a Master's degree. At the vocational education level, the teacher is required to possess a Master's degree or Bachelor's degree. An example of the structure of the masters degree programme of a subject teacher at the University of Helsinki, Finland is presented Figure 3. Teaching and guidance staff within day-care centres generally have Bachelor's degrees. Pre-primary teachers in schools hold a Master's degree (Finnish National Agency for Education, 2019). Other teachers such as guidance counsellors in the basic and upper secondary education and training, and teachers that teaches the special needs students must possess a Masters degree and additional training in counselling or special needs teacher studies respectively. Teachers at higher education institutions for example, Universities of Applied Sciences should possess a Master's and a pedagogical studies. Whereas, a University teacher should hold a Doctoral or other postgraduate degree (Finnish National Agency for Education, 2019).

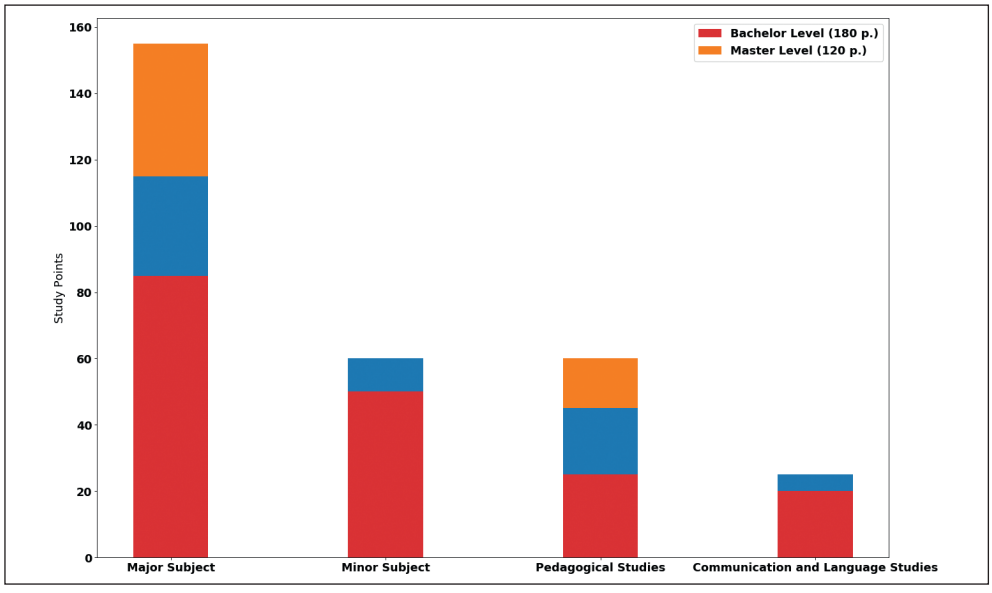
Figure 6. Qualified teachers by level of education in Finland in 2015.



Source: Finnish National Agency for Education (2018)

The training and education of a teacher in Finland could be completed simultaneously during Masters degree programme combined with pedagogical training. Otherwise, the teacher obtain the Masters degree then complete the pedagogical education, for example, the case of vocational teacher education. In addition, Finnish teachers are obligated to partake in the in-service training, continuing professional development (CDP) or mobility periods every year, funded by the state (Finnish National Agency for Education, 2019).

Figure 7. Structure of the master degree of a subject teacher: 3 + 2 years at the University of Helsinki.



Source: Jari Lavonen, Department of Teacher Education, University of Helsinki, Finland.

In Finland, a primary school teacher normally teaches at grades 1 to 6, pupils of ages 7 to 13, and teaches usually all the 13 subjects. Whereas, a subject teacher normally teaches at grades 7 to 12, pupils of ages 13 to 19, and teaches usually one major and one minor subjects, for example, biology and chemistry.

Examples of ICT as tool for education and innovation in Finland

Finland's policy of innovation and education seeks to establish an environment for enterprises and educational institutes to promote audacious innovation and international growth. The stakeholders in Finland perceive very clearly that foundation for innovation is education and e-skills. So, the educational policy of Finland draws its strength from a wide range of sectors. Since the beginning of the millennium, the importance of ICT in education in Finnish educational institutes has been stressed in many policy documents. In Finland, the guidelines for national curriculum used in schools and educational institutes are broad. Hence, it gives freedom of choice to schools and teachers to adapt and use any content or method (e.g. the use of ICT solutions) in classrooms. So, a teacher decides when and where to use ICT in educational context. Also, the education system in Finland is highly decentralized as well as flexible and it gives the independence to municipalities to offer ICT solutions to the teachers teaching and students studying in certain regions. Firstly, the Digabi project initiated by the board of Matriculation Examinations deals with the electronic examinations of students using ICT. In this project, generally teachers and students find the opportunity to utilize the Abitti test system. Abitti was born of the need to give the students participating in the Baccalaureate and to the upper secondary school students the opportunity to familiarize themselves with the test system of the Baccalaureate. After the test, the results are transferred to a web service where teachers can read and evaluate the test performance. After the assessment, the teacher can send the test results to the email address indicated by the examiners. Secondly, the Opeka (an online web-based service) provides teachers and educational institutions as well as local municipalities stakeholders to monitor the usage of ICT in local schools as compared to other school in Finland. The Opeka offers services like feedback for the teachers, support for information and communications solutions planning and evaluation of the results of ICT usage. Moreover, for creating and sharing content digitally, teachers use Linkkiapaja which is same as a search engine to find content produced in Finland using public money. This includes selected and classified online teaching and learning material. A selection of appropriate line drawings and photos of instruction are selected in addition to current learning materials and learning objects. The Finnish National Education Agency is developing and maintaining Linkkiapaja service. Similarly, the edustore.fi is a similar service but it is mainly used to distribute commercial learning content. The teachers can use edustore.fi to produce and share the content in

their local school or in the nationwide system. In addition to this, teachers also tend to use ICT services such as Moodle, Pedanet, Optima and Claned. In a nutshell, Finland is utilizing ICT services to create better and engaging learning environments. It is true that there isn't any national policy that restrict each school to use a certain solution, though municipalities and local school administration decides which ICT services they want to use according to their needs. Hence, such policies make Finland a leader in the field of education.

In the life of young people, the internet is now a playing central and multifaceted role by way of gathering information and a tool for virtual communication and participation. It has also played a huge role as an arena for publishing, sharing and adding comments to different texts types, piece of art, music, videos and more. Consequently, the use of ICT in and outside the school for young people are quite different and teachers are obliged to identify this.

In Nordic countries, particularly Finland, digital literacy is gradually affirming its position among the essential cultural skills like reading and writing. However, several studies indicate that the use of ICT in formal schooling rarely give room for use of new technologies and seldomly support young learners to achieve necessary digital skills that aid their academic skills. Male students' ICT skills are rather acquired in informal learning contexts, at home and/or with friends where the information processing skills do not necessarily improve and develop. Furthermore, the internet is often used mainly for information search without student practicing information analysis and organization.

In contrast, there are lots of cases reported as per good practice of ICT in formal schooling to foster digital skills. For example, there are cases where teachers implement ICT on school task in a way that collaborate the school-based subject content, the student role and teacher authority with out -school practices such as multitasking, mixing media and modalities and knowledge creation.

The FICTUP, Fostering ICT Usage in Pedagogical practices: Experience teacher applying ICT in their classroom

The FICTUP project aimed at transforming expert teachers' pedagogical practice with technology through scenarios, short video and tutoring. The project was on a European level, but however, there were two notable Finnish cases cited in which two primary school teachers in Finland designed educational scenarios and applied them in their classroom (Giovannini, et al. 2010).

First case scenario: Students carried out an inquiry in small groups, practicing scientific skills such as formulation of research questionnaires and hypothesis, making and documenting observations and writing and commenting scientific explanation (Giovannini, et al. 2010). A web-based collaboration system was used for structuring the inquiry process through the working spaces and written instruction created by the teacher for

collaborative commenting, documentation and presenting of the results. The educational objective of this case was to learn the subject domain content and also to improve more general skills such as writing skills, information search and categorization of knowledge skill, science skills and collaborative skills. The process also had various phase where the student took turns in working alone, in pairs and in teams (Giovannini, et al. 2010). The following skills were fostered during through the student activities, organized and scaffolded by the teacher.

I. Communication and interaction practices through web technology with the use of virtual brainstorming tool.
II. Understanding and improving skills for collaborative knowledge production
III. Knowledge seeking and knowledge application skills
IV. Technical digital skills; where the students managed multiple working space in the computer and in the web-based system and constantly moved between them. They also learned how to work by following written instruction instead of leaning on traditional teacher's oral instruction.

Second case scenario, school children's web journal: For this project, 11- 12 years old primary school students created stories for a virtual school magazine. The student worked in school two hours per week and spent some time on it at home during their free time. Student used digital notepad, digital cameras, interactive whiteboards and worked with a magazine factory. This was their first time on such a project but however, the had previous hands on ICT applications (Giovannini, et al. 2010).

The project was aimed at student getting acquainted with the principles of publishing a journal, creating web journal and practicing editorial tasks. More so, the student can develop skills for creating and developing digital materials through practicing writing for a story in the journal, practicing shooting with digital camera and image processing and also pasting text and pictures in a publishing software. During the project, the following digital skills were fostered through student activities, organized and scaffolded by the teacher.

I. Writing practices with technology; while bearing in mind that they wrote for an authentic audience
II. Understanding and improving skills for virtual creation
III. Improving understanding about virtual content and journal especially
IV. Technical digital skills with notepad, digital camera for improving and transferring texts and pictures respectively to the journal template.

Changes in pedagogical practices instead of focusing on technology

The obligation of formal school includes taking care of every student's digital competence by revising the traditional pedagogical practice. Presently, this is not the situation

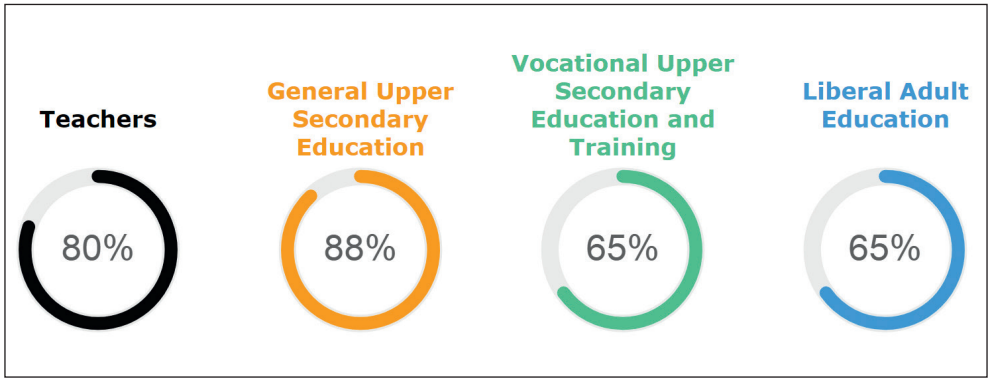
at least to a wide extent. Counting on the informal learning is not enough for adequate competence assurance. For development of digital competence, sustainable educational structures are essential.

The two classroom scenarios are examples of well-planned process in which the whole real pedagogical setting is modified. Educational changes ought to take place in knowledge practices. That is, how are they guided to use knowledge resources, how do students work with knowledge from the internet and are they active content creators and not just users. The pedagogical and knowledge practices are as important as the use of technology for improving digital literacy.

Continuous professional development among teachers in Finland

In Finland, it is understood that teachers obtain a chunk of core professional skills outside of formal educational settings (Heikkinen, Jokinen & Tynjälä 2012). According to Villegas-Reimers (2003), Continuous professional development (CPD) is a "lifelong process" which starts with the early training that teachers undergo and linger until retirement (Guiden & Brennan 2017). CPD or professional mobility plays a crucial and relevant role in guaranteeing the constant improvement of teachers' skills, and in a long run, the quality of teaching. CPD is compulsory (VESO training) for every teacher in Finland, and must be completed on an annual basis. Figure 1 shows the percentage of teachers and principals in Finland who have participated in CPD or professional mobility in 2015. CPD is organised by different types of training institutions across Finland, for example, by private companies in education business, lifelong learning and continuing education units of the university, vocational teacher education institutes, university departments of teacher education, teacher training schools, and summer schools.

Figure 8. Percentage of teachers and principals in Finland who have participated in CPD in 2015



Source: Finnish National Agency for Education (2018)

Milestones and advances of learning technology innovation in Finland

Blockchain Technology

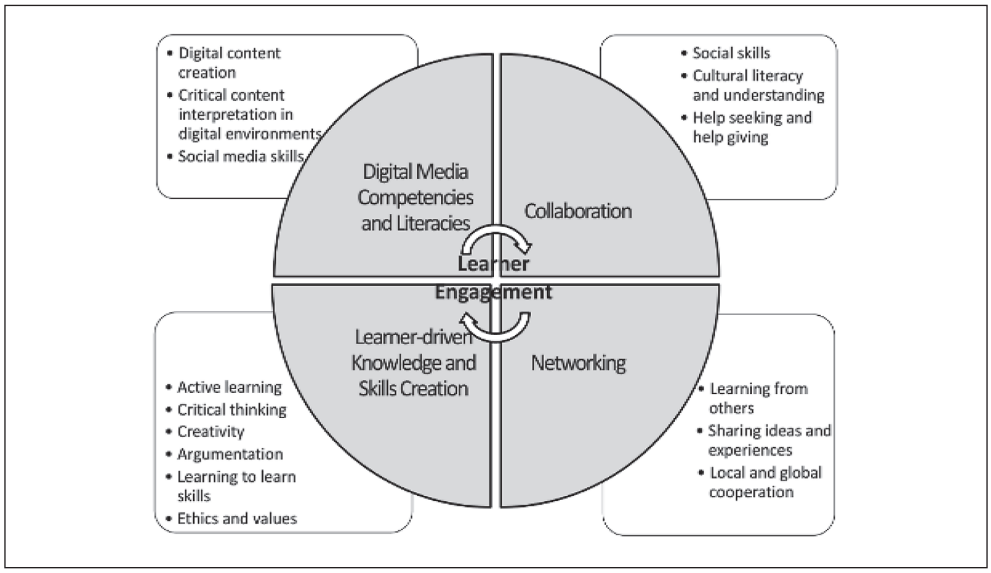
Volpicelli (2016) defined blockchain as "shared or distributed or decentralized digital ledgers which use cryptographic algorithms to verify the creation and transfer of digitally represented assets or information over a peer-to-peer network". In 2008, when Bitcoin first appeared, the term blockchain, back then used as „block chain" was glued to the Bitcoin digital currency. It was not until Ethereum introduced their Smart Contracts in 2015, that blockchain was finally released from its exclusive tie to Bitcoin and went on to be adopted by other sectors like healthcare and education. Blockchain provides a decentralized, distributed public and trusted ledger upon which two parties can perform transactions without necessarily trusting each other, and without reliance on a central third party (Oyelere et al. 2019).

Recently, Finland is advancing its research and development by looking at the new advancement in technology that blockchain has brought. The first blockchain and bitcoin conference in Finland was held in Helsinki in the year 2018. The conference theme was focused on discovering the prospects of blockchain and cryptocurrency for business. The integration of blockchain into Finnish government strategic sectors such as the Immigration Service (Migri) has been helpful in managing the refugees and asylum seekers who have no trace of valid travel papers (Rayner, 2018). For example, blockchain technology offers an interesting solution by tracking the identity refugee on a ledger in the form of immutable and independently verified records. Blockchain technology, deployed via Ethereum, maintains a record of the financial transactions made by an individual with a card (https://en.reset.org/knowledge/blockchain-digital-system-real-world-sustainability-08282017).

Global Sharing Pedagogy

Global Sharing Pedagogy GSP relies on four learning pillars, namely learner-driven knowledge and skills creation, collaboration, networking and digital media literacy. These pillars further engage the student into the learning activities (https://www.igi-global.com/dictionary/global-sharing-pedagogy/59888).

Figure 9. The concept of Global Learning Pedagogy



Source: Hannele, et al. (2014)

Flipped Learning

Flipped Learning is a pedagogical approach aimed at transforming learning space into a dynamic, interactive, and personalized learning environment where instructors creatively guide students on a subject matter. This type of pedagogy mandates that the students consult the learning material on their own before the class time, and are engaged in practice, group discussions, and task-based exercise during class meeting times.

Flipped Learning in Finland: Case study of the University of Eastern Finland (UEF)

Since 2016, team Ameba sought to promote research-based development of learning environments at UEF. Approximately 100 teachers at UEF have received training in flipped classroom, and around 8000 students have been part of a flipped course. As Part of this experience, both the Ameba team and the participating teachers have documented the lessons learned from their experience on a manual on flipped learning, which is Retrieved from Finnish at: www.uef.fi/flippaus (UEF, 2016).

Digital Storytelling

The term digital storytelling (DST) has been popularized by the Center for Digital Storytelling, which promotes DST as a means of "providing a voice for community

groups" (Flottemesch, 2013). DST engages students in a deep and meaningful way when used in a learning context (Tomczyk, et al. 2019). Digital Storytelling facilitates the building of learning environments that adopt the constructivist learning theory. It enhances learners' motivation, and fosters a culture of problem-solving based on collaboration and peer-to-peer communication. It also engages learners in a deep learning process, and gets them to think in constructive way.

Digital Storytelling in Finland, case study of FINNABLE 2020

In Finland, DST has been introduced in classes as a 21st-century skill for teaching and learning (Mäenpää, 2013). For example, mobile video experience has already been used for educational purposes in Finnish schools and internationally for learning storytelling (Hannele et al., 2014). By telling digital stories for pedagogical purpose that emanates from their life experience, teachers and students are able to build relevant contents that is shared for learning (Helminen, 2012). Digital Storytelling and the ways it can support in students' learning experiences were investigated as part of the FINNABLE 2020 research project (Harju, Viitanen, & Vivitsou, 2014). The FINNABLE project creates a learning ecosystem that allows learning anywhere. The key objective is to develop and create technology-driven practices that add value to learning and teaching. The goal is to create new methods for sharing knowledge and experiences and to promote the skills of the 21st millennium that emphasize creativity and problem-solving skills.

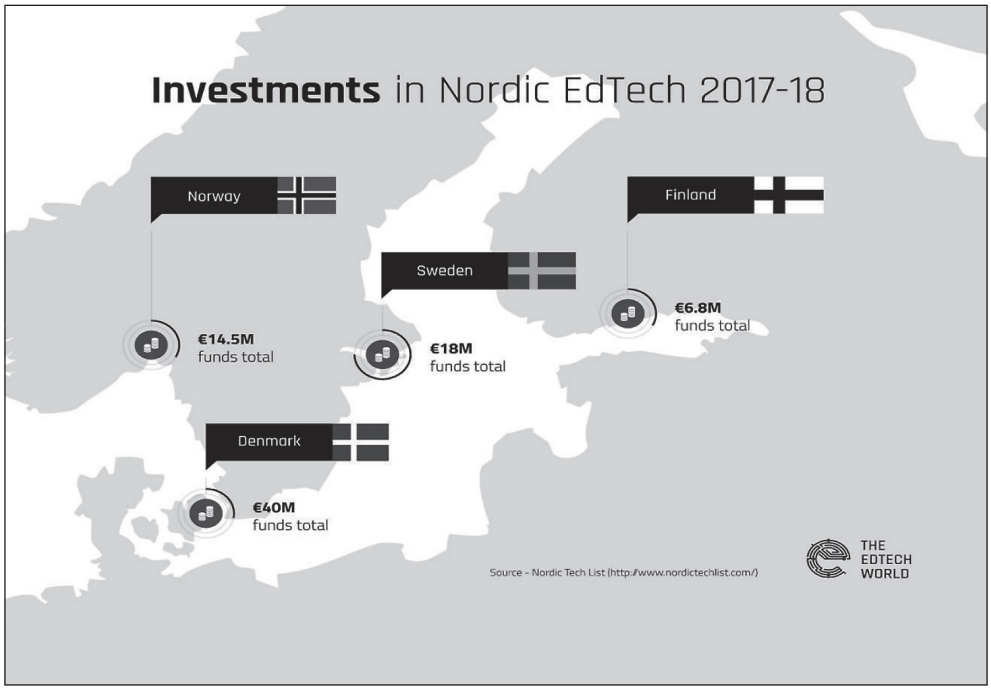
During Autumn 2013, a study was conducted in which DST was used in 18 Finnish classes (Harju, Viitanen, & Vivitsou, 2014). The outcome of the study indicated that can be integrated in several school subjects to improve the learning experience, collaboration and ICT skills of the leaners. As part of the FINNABLE 2020, a system called Mobile Video Experience or MoViE was developed. It is a web-based interface allowing users to upload and share stories they recorded with the phone cameras. It allows students to share their stories, remix, annotate and comment them. While interacting with the environment to accommodate the desired changes, via editing their clips, commenting and annotating them, students become authors of the stories, and by interacting with stories shared by others on the platform they become audiences (Harju, Viitanen, & Vivitsou, 2014). Their study revealed that the use of mobile videos both in the classroom and outside the classroom can provide an engaging experience. The engagement seems to combine both an emotional aspect, such as fun, and a commitment to hard work. In addition, group work, co-creation, and the MoViE platform were important factors for motivating students to learn and work with video stories. Besides, Finnish teachers' experiences about using DST in teaching showed that DST activated students to learn and the method provides space for learners to work independently and to use their own expression and creativity. It was however discovered that teachers emphasized that DST required them to have self-confidence and engage

in careful project planning. For example, one of the teachers asserts "I think that the teacher's most important task is to consider how to evaluate the process and to teach students to see what their own part was during the activity. DST requires tolerance of uncertainly, technical skills, time management, and skills for grouping students" (Harju, Viitanen, & Vivitsou, 2014. pp.53).

Business aspect of ICT in education and inclusion in Finland

More than 80 EdTech startups and 150 established EdTech related companies exist in Finland with more popping up every year, according to 2018 statistics. (Source: https://medium.com/the-edtech-world/finnish-edtech-729e15fb37bc). According to the EdTech World, 6.8 M$ of funds has been invested in EdTech companies in Finland for the duration 2017-2018. Figure 1 presents the investments in the Nordic region.

Figure 10. EdTech investments in Nordic region between 2017 and 201



Source: http://www.nordictechlist.com/

EdTech startups develop solution to support various aspect of education. Below is a sample list of startups in the EdTech industry in Finland. The data is fetched from: tracxn.com using the keywords: Finland and EdTech.

Table 11. Sample startups for EdTech scene in Finland.

Company	Description
Yousician	A mobile and web app that listens to users playing musical instruments and then provides real-time feedback and improvement strategies. It also provides a progress tracker for learners.
Claned	Claned is a personalized and adaptive learning platform for corporates, educational institutions, and individuals. The platform uses artificial intelligence and real-time learning analytics to provide the educator and the learner with insights on study performance, orientation, and motivation. Students can access learning material, collaborate, and create personalized learning goals. The platform generates data points by capturing user's interaction with the system to create profiles and groups with similar learning dispositions based on the data.
3DBear	3DBear provide gamified learning application for schools and educational institutions. Offer game modules relying on 3D printing, Virtual Reality (VR) and Augmented Reality (AR) to teach 3D modeling, printing, and robotics to students. Available on App Store, Google Play and online. Clientele includes Finnish National Agency for Education, Elementary and upper secondary schools and vocational institutions in Finland, Junior Library Guild in the USA, Alta Vista and Palo Alto schools in California, USA
Fuzu	Fuzu is a job board and recruitment marketing platform. Fuzu started as a career guidance platform and then added an employment portal. Helps candidates search for jobs, take up online courses and get career advice. Candidates can search jobs based on keywords, category, and location. Employers can post jobs, create branded company pages and search through the candidate database. Helps screen candidate personality and rank CVs. Offers career readiness programs in disciplines like accounting, finance, banking, insurance, etc. Pricing for recruitment campaign starts at KSh 2,999, for database search starts at KSh 8,999 and creation of company pages starts at KSh 49,999.
WordDive	WordDive is an adaptive language learning platform. It optimizes the learning speed and exercising of study items for each user by enabling multiple senses for permanent learning. The learning languages include English, German, Spanish, Finnish, Italian, Japanese, Swedish, Russian, and more. Offered on a monthly subscription. Was chosen as the Best e-Learning Solution in Finland 2011.
Musopia Ltd	Musopia Ltd is a mobile app development studio dedicated to creating music software. The apps developed by Musopia are Four Chords which provides chords and lyrics, Ukeoke which helps to learn new songs, Chord shaker which provides easy chords and lyrics in karaoke style. They partner with guitar manufacturers in the music industry to create learning experiences and branded applications that turn new guitar players into loyal, repeat customers
TeacherGaming	TeacherGaming is an educational game development company. They create educational versions of popular games to be used in classrooms. Products include MinecraftEdu, a school-ready version of Minecraft and KerbalEdu which allows students to build rockets & learn about the solar system is based on the Kerbal Space program. They have also created a marketplace for online educational games called the TeacherGaming Store.
Lightneer	Lightneer is a learning game developer. Launched the , Big Bang Legends' game (currently discontinued) for school children to learn particle physics. BigBangLegends learning environment combines a new physical learning environment, mobile & card games, and learning through an interactive science hub.
10monkeys	10monkeys offers app-based educational resources for primary school students. Provides games, leaderboards, and interactive feedback to learn maths. Available for iOS and Android platform.

Hexlet	Hexlet provides online courses for programming. Topics include programming languages, web development, Database management and administration. Content includes videos, live exercises and educational resources for learning. Provides a platform for discussion and forums. Content is created by the in-house team. Also conducts live webinars with teachers on the topics. Works on the subscription-based pricing model.
Eliademy	Eliademy provides a free online classroom platform that allows educators and students to create, share and manage online courses with real-time discussions, task management and certificate of completion. Also provides administration interface for HR personnel. Offers premium model with some additional functionalities. Also offers online courses marketplace, course completion certificates, grading tools and analytics support. Share 70% of all revenue with tutors in online courses marketplace.
Mightifier	Mightifier is a platform for children to learn emotional & social skills. It encourages students to provide each other with positive feedback. teachers can view through their dashboards and provide support. Available on iOS & Android in English & Finnish.
Tablet School	Tabletkoulu provides e-learning material & teaching tools to educators. Materials replace traditional textbooks as they are aligned to the curriculum. Clients are primarily K12 schools. Also, provides a dashboard for monitoring students' progress and assign badges to encourage students. Students can buy educational material. Teachers get access to materials for free but need to pay fo other features.
Sanako	Sanako provides SaaS platforms for language learning. Provides software and hardware-based products for digitalizing language labs for classrooms and cloud-based solutions for creating a virtual environment. Teachers can monitor, assign and grade assignments. Students are provided with digital recorder units for device interaction and group collaboration. Also teaches sign language to students.
MusiClock	MusiClock is an app to assist in learning guitar & pianos. This mobile app, launched in April 2015 in Finland and New Zealand lets the user select the backing track they prefer to play genres' like blues, rock, jazz etc. and the app will show scales that fit that track. The wrong notes are automatically eliminated from view and the user can simply rotate the clock-like display to get new chords that fit that backtrack.
Kide Science	Kide Science offers gamified learning resources for children. Provides story-based lessons, TV series, books, and more. Caters to 3 to 8-year-old kids. Allows children to learn natural science. Also caters to schools.
Moomin Language School	Moomin Language School, a product of Promentor Solutions Oy, is an online language learning solution for young learners. Teachers can use the app in classrooms. Offers games to teach languages to kids. Games also develop their mobility, memory and social skills for children to improve their hand-eye coordination, mathematical thinking, logical reasoning. Aligned with Finnish curriculum.
SkillPixels	SkillPixels offers SmartKid, a math game, for kids of 4-8 yrs available on iPad. Turns schoolbooks into educational games with learning analytics integration. Aligned with Common-Core curriculum. Available on iOS and web. Winner of Best Educational Solution, Finland, 2013 and Best Mobile Service, Finland, 2013.
Lola Panda	Lola Panda games, developed by BeiZ, are educational games for children. Some of their games include are Math, sudoku, puzzle and alphabet games. Apps have audio based instructions and target kids aged 3-8. Available for Android, iOS, Nintendo and Windows

Source: tracxn.com

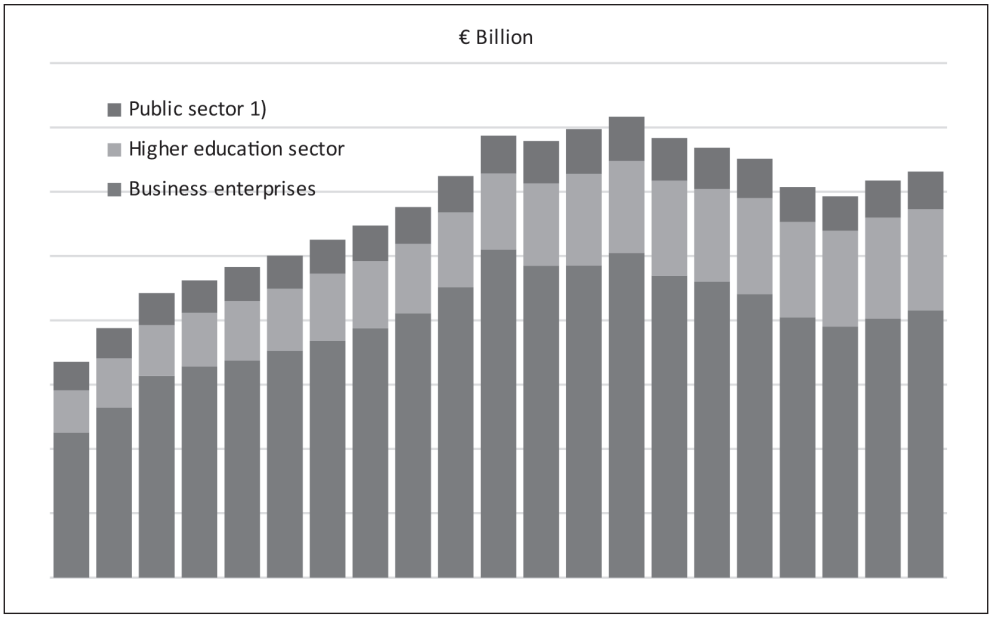
The Finnish workforce has the highest proportion of ICT specialists in the world. Finland has also Europe's highest percentage of ICT-related patents (http://www.oecd.org/internet/oecd-digital-economy-outlook-2015-9789264232440-en.htm).

Relative to the population, Finland has the third most professionals working in research and development (https://www.bloomberg.com/news/articles/2017-01-17/sweden-gains-south-korea-reigns-as-world-s-most-innovative-economies).

Finland is in the world's top countries when it comes to competitiveness. Finland is #1 in competitive innovations supported by the excellent availability of scientists & engineers and a high degree of collaboration between universities & industry (http://reports.weforum.org/global-competitiveness-index-2017-2018/competitiveness-rankings/#series=GCI.C.12).

Over the years, there has been an increase in budget expenditure in several important sectors in Finland, such as the higher education, business, and public sector. Figure 2 shows Finland's research and development expenditure, Table 2. Shows particularly the total funds expended for research and development in Finland and Table 3 indicate the internet sales and e-commerce enterprises in Finland.

Figure 11. Finland's research and development expenditure.



1) Including private non-profit sector
2) Estimate based on survey responses and other calculations

Source: Official Statistics of Finland (OSF): Research and development [e-publication]. ISSN=2342-6721. Helsinki: Statistics Finland [referred: 4.5.2019]. Access method: http://www.stat.fi/til/tkke/index_en.html

Table 12. Total funds expended for research and development in Finland

	Business enterprises	Public sector [1)]	Higher education sector	Total
	€ billion	€ billion	€ billion	€ billion
1998	2,253	444	658	**3,355**
1999	2,644	470	765	**3,879**
2000	3,136	497	789	**4,423**
2001	3,284	501	834	**4,619**
2002	3,375	530	926	**4,830**
2003	3,528	515	962	**5,005**
2004	3,684	530	1,040	**5,253**
2005	3,877	555	1,042	**5,474**
2006	4,108	574	1,079	**5,761**
2007	4,513	565	1,165	**6,243**
2008	5,102	589	1,181	**6,871**
2009	4,847	657	1,283	**6,787**
2010	4,854	692	1,425	**6,971**
2011	5,048	684	1,432	**7,164**
2012	4,695	662	1,475	**6,832**
2013	4,602	644	1,438	**6,684**
2014	4,410	613	1,490	**6,512**
2015	4,047	543	1,481	**6,071**
2016	3,902	535	1,490	**5,926**
2017	4,028	578	1,567	**6,173**
2018 [2)]	4,156	583	1,573	**6,312**

1) Including private non-profit sector
2) Estimate based on survey responses and other calculations

Source: Official Statistics of Finland (OSF): Research and development [e-publication]. ISSN=2342-6721. Helsinki: Statistics Finland [referred: 4.5.2019]. Access method: http://www.stat.fi/til/tkke/index_en.html

Table 13. Internet sales and e-commerce enterprises in Finland excluding enterprises with under 10 employees

	Internet-sales		EDI-sales [1]		E-commerce, total	
	€ billion	% [2]	€ billion	% [2]	€ billion	% [2]
2006	14	5.2	26	9.6	40	14.8
2007	17	6.1	29	10.0	46	16.1
2008	18	6.1	33	10.9	51	17.0
2009	15	6.1	29	11.6	44	17.8
2010	17	6.4	36	13.2	53	19.6
2011	19	6.7	34	11.7	53	18.5
2012	12	3.8	38	12.3	50	16.1
2013	15	5.0	44	14.3	59	19.2
2014	15	4.6	52	16.4	67	21.0
2015	17	5.8	47	16.0	64	21.8
2016	18	6.2	42	14.4	60	20.6
2017	19	6.0	47	14.7	66	20.7

[1] Electronic data interchange between organizations (EDI)
[2] % of turnover

Source: Official Statistics of Finland (OSF): Use of information technology in enterprises [e-publication]. ISSN=2489-3234. Helsinki: Statistics Finland [referred: 4.5.2019]. Access method: http://www.stat.fi/til/icte/index_en.html

Education Finland is a national education export program, offering Finnish educational know-how and learning solutions globally. Several companies that represent the best of Finland from all aspects of education for example, based on the principle of lifelong learning are listed on the Education Finland platform (https://www.educationfinland.fi/companies). To become a member of the Education Finland, the company must meet a high standard set by the organization. We filtered the database of Education Finland using the "learning materials and educational technology" and "all educational level" options and received 52 hits of companies registered that provide business services in the educational technology field in Finland (see Table 4).

Table 14. Companies in education related business in Finland

Company	Area Of Focus	Website address
3dbear	Learning Materials And Educational Technology	3dbear.io
Aida Educare / Finnish Education Learning And Development Centre	Educational Travel And Visits Learning Materials And Educational Technology	educentre.fi
Airport College International Ltd	Corporate Training Learning Materials And Educational Technology	airportcollege.com
Arbonaut Ltd	Learning Materials And Educational Technology	arbonaut.com
Breino Oy	Learning Environments Learning Materials And Educational Technology	breino.com
Caprice Oy / Minifiddlers	Educational Travel And Visits Learning Environments Learning Materials And Educational Technology School Concepts Teacher Training And Educational Leadership	videos.minifiddlers.org
Cimson Oy / Neba	Educational Travel And Visits Learning Environments Learning Materials And Educational Technology School Concepts Teacher Training And Educational Leadership	nebatraining.eu
Claned Group Ltd.	Learning Materials And Educational Technology	claned.com
Cloubi Ltd	Learning Materials And Educational Technology	cloubi.com
Cuppla	Degrees And Qualifications Educational Reforms Evaluation And Quality Assurance Learning Environments Learning Materials And Educational Technology	cuppla.co
Edita Publishing Oy	Educational Reforms Learning Environments Learning Materials And Educational Technology School Concepts Teacher Training And Educational Leadership	editapublishing.fi
Eduexcellence Ltd	Degrees And Qualifications Educational Reforms Evaluation And Quality Assurance Learning Materials And Educational Technology Teacher Training And Educational Leadership	eduexcellence.fi
Edutat	Educational Reforms Evaluation And Quality Assurance Learning Environments Learning Materials And Educational Technology Teacher Training And Educational Leadership	edutat.fi
Eduten	Learning Materials And Educational Technology	eduten.com
Finland University	Degrees And Qualifications Evaluation And Quality Assurance Learning Materials And Educational Technology	finlanduniversity.com

Company	Area Of Focus	Website address
Finnish Global Education Solutions	Learning Environments Learning Materials And Educational Technology School Concepts Teacher Training And Educational Leadership	fges.fi
Finpeda Ltd.	Learning Environments Learning Materials And Educational Technology School Concepts Teacher Training And Educational Leadership	finpeda.fi
Fun Academy	Educational Travel And Visits Evaluation And Quality Assurance Learning Materials And Educational Technology Teacher Training And Educational Leadership	funcademy.fi
Funzi	Evaluation And Quality Assurance Learning Environments Learning Materials And Educational Technology School Concepts Teacher Training And Educational Leadership	funzi.fi
Graphogame	Learning Materials And Educational Technology	graphogame.com
Gribbing Oy	Learning Materials And Educational Technology	grib3d.com
Into School	Learning Materials And Educational Technology	intoschool.org
Itä-Uudenmaan Koulutuskuntayh-tymä/Edupoli	Educational Travel And Visits Evaluation And Quality Assurance Learning Materials And Educational Technology School Concepts	careeria.fi
Jamk	Degrees And Qualifications Educational Reforms Educational Travel And Visits Evaluation And Quality Assurance Learning Environments Learning Materials And Educational Technology School Concepts Teacher Training And Educational Leadership	jamk.fi
Kamk	Learning Environments Learning Materials And Educational Technology Teacher Training And Educational Leadership	kamk.fi
Kasauma Education Oy / Keeduu	Degrees And Qualifications Learning Environments Learning Materials And Educational Technology	keeduu.com
Kide Science	Learning Materials And Educational Technology	kidescience.com
Kokoa Standard	Educational Reforms Evaluation And Quality Assurance Learning Environments Learning Materials And Educational Technology	kokoa.io
Lapin Amk	Degrees And Qualifications Educational Travel And Visits Learning Environments Learning Materials And Educational Technology Teacher Training And Educational Leadership	lapinamk.fi

Company	Area Of Focus	Website address
Mobie Academy	Educational Reforms Evaluation And Quality Assurance Learning Materials And Educational Technology School Concepts Teacher Training And Educational Leadership	mobieacademy.fi
Moilo	Learning Materials And Educational Technology	moilo.fi
Opintiet Oy	Educational Reforms Educational Travel And Visits Evaluation And Quality Assurance Learning Environments Learning Materials And Educational Technology School Concepts Teacher Training And Educational Leadership	opintiet.fi
Otava	Evaluation And Quality Assurance Learning Materials And Educational Technology	oppimisenpalvelut. otava.fi
Paths To Math Ltd	Learning Materials And Educational Technology Teacher Training And Educational Leadership	pathstomath.com
Playvation Oy	Learning Environments Learning Materials And Educational Technology	moominls.com
Polar Partners Ltd.	Educational Travel And Visits Evaluation And Quality Assurance Learning Environments Learning Materials And Educational Technology School Concepts	polarpartners.fi
Prodiags	Learning Materials And Educational Technology	prodiags.com
Qridi	Evaluation And Quality Assurance Learning Materials And Educational Technology School Concepts	qridi.com
Sanako	Learning Materials And Educational Technology	sanako.com
Sanoma Pro	Evaluation And Quality Assurance Learning Environments Learning Materials And Educational Technology	sanomapro.fi
School Day Helsinki	Learning Materials And Educational Technology	schoolday.fi
Sedu Education	Degrees And Qualifications Educational Reforms Educational Travel And Visits Evaluation And Quality Assurance Learning Environments Learning Materials And Educational Technology School Concepts Teacher Training And Educational Leadership	sedu.fi
Seppo	Learning Environments Learning Materials And Educational Technology	seppo.io

Company	Area Of Focus	Website address
Skhole Inc	Learning Environments Learning Materials And Educational Technology	skhole.fi
Team Action Zone	Degrees And Qualifications Educational Travel And Visits Evaluation And Quality Assurance Learning Environments Learning Materials And Educational Technology Teacher Training And Educational Leadership	taz.fi
Thinglink	Educational Reforms Learning Environments Learning Materials And Educational Technology Teacher Training And Educational Leadership	thinglink.com
Tieturi	Evaluation And Quality Assurance Learning Materials And Educational Technology	tieturi.fi
Turun Amk - Turku University Of Applied Sciences	Degrees And Qualifications Educational Reforms Educational Travel And Visits Evaluation And Quality Assurance Learning Environments Learning Materials And Educational Technology Teacher Training And Educational Leadership	tuas.fi
Tuudo	Learning Materials And Educational Technology	tuudo.fi
Utelias / Elias Robot	Learning Materials And Educational Technology	eliasrobot.com
Viope Education	Learning Materials And Educational Technology	viope.com
Workseed	Evaluation And Quality Assurance Learning Materials And Educational Technology	workseed.fi

National recommendation to SELI project

Finland has clearly the required human and technical resources to implement and further develop technologies to be successfully integrated in K-12 and higher education. For this project, based on the presentation given by the members of the SELI project and the data gathered in this report we recommend a simplification of the Digital Storytelling process.

The digital storytelling (DST) process goes as follows:

- A story circle is formed, where members can tell fragments of their personal stories. The inclusion criterion is to be respected by ensuring the equal say principle, which the story facilitators will enforce.
- Taking notes is the second step of the process, and everyone will share their notes for group reflection.
- Voice recording is then conducted, with the help of the facilitators – depending on the need of the participants-.
- Non-commercial and personal images can be used in the next step to illustrate the stories.

- Multimedia editing software are then used to combine the voices with the pictures, as DST is an audio-visual expression.
- The digital stories made are then to be shared with the consent of the digital storyteller.

The process described above, though not very rigorous, communicates effectively the required steps of creating digital stories, while ensuring the inclusion criterion thanks to the work of the facilitators. The work with digital media can also enhance the digital skills of the participants, which builds their knowledge not just in the ideas that were intended to be communicated but also in terms of ICT skills. This makes digital storytelling an effective pedagogical tool.

We suggest that SELI simplifies this process by offering an adaptive web interface wherein learners can exchange stories, without necessarily being together in the same room, allowing inclusion to people who are physically unable to attend the story circle. The interface should then allow user to take notes either using typing or with speech to text. The interface should allow learners to record their voices, without needing to use a third-party software. In here, we aim at putting everything in the same place so that the learners can have an easier task telling and making digital stories. In the next activity, the web interface should have a database of pictures to be used to illustrate the stories and should allow the learners to merge these pictures with the recorded sounds, to create the digital story. Lastly, using blockchain, every storyteller owns his/her story and decides who has access to it and which type of access they should have. This should be doable using blockchain technology, which is a perfect fit to privacy and ownership issues.

As expressed by Jaakkola (2013), Finland has a good ICT infrastructure in schools, but teachers utilise these infrastructures extremely poorly. Inclusive education is not about placing learners into standard settings by reacting to their personal needs, but it should transform tutoring, "to support education for all and remove barriers to participation and learning. For disadvantaged groups, essential links must be made between the reform of the education system and other policies such as those to alleviate poverty, improve maternal and child health, promote gender inequality and ensure environmental sustainability and global partnership." (D'Alessio et al., 2010). We recommend that the first step towards inclusion of disadvantaged students should be the training of teachers and educational staff. It is not enough to provide the technology to the disabled people, but the teachers are also required to be trained in education and pedagogy to support learners with diverse needs to include them in education settings using ICT for learners with disabilities and special needs.

Aside from providing digital technology to support physical disabilities, it is also equally important that SELI project try to help them enhance their self-esteem and encourage them to participate in classroom activities and social activities. The mere tool to help them to access the technology and resources does not ensure their equal participation and integration in the society. It is still a challenge to make them able to learn, work

and integrate in the community as a normal being. We recommend that future technology developments in Finland ensure both inclusive education and job for the disadvantaged groups.

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ICT, DIGITAL LITERACY, DIGITAL INCLUSION AND MEDIA EDUCATION IN POLAND

Abstract: The chapter presents the conditions related to the use of ICT in the didactic process in Polish schools and the phenomenon of e-inclusion. It contains references to the most up-to-date and relevant resources showing how digital media are being used by students and teachers. In this context, the advantages and disadvantages of introducing digital media into Polish education system are discussed. The important part of the text is the presentation of the financial aspects of media pedagogy as well as the challenges concerning the introduction of new didactic methods and means based on the new media.

Keywords: media education, digital literacy, inclusion, learning, Poland

ICT IN EDUCATION — AN OVERVIEW

At each stage of education the contemporary schools have an important task of preparing their students to live in the information society – a society of "knowledge producers", where knowledge becomes a process and learning is the integral part of production, a new form of activity. In such society, almost all forms of activities taken support Information and Communication Technology (ICT) treated as the key technologies in modern civilisation. The reality of the digital age presents constantly changing and

growing requirements for students and teachers, focusing on developing certain areas of information literacy. These requirements set the directions of development and the activities introduced in and out of schools (Baron-Polańczyk, 2018).

Computerisation of Polish schools began in the 1980s. During the last decade of the 20th century Polish students began to learn IT at school. IT laboratories got equipped with computers and the Regional Teacher Training Centres were offering courses to prepare teachers to teach the new subject. At that time, the curricula and the frameworks of IT classes were developed. A very important change in IT education in the Polish schools was the launch in 2012 of the pilot programme called Digital Poland (Polska Cyfrowa). The purpose of the programme is to strengthen the competencies of students and teachers in the area of ICT use (Marzantowicz, 2016).

According to studies conducted by prof. Marlena Plebańska and her team (University of Warsaw), teachers complain about quality of school equipment, outdated hardware and software. However, accessibility of the Internet is evaluated as good in 42% and very good in 27% of schools. One in three respondents points out that their school offers free wireless connection. It is most often in upper-secondary schools (up to 50%). It is also important that 48% of schools have only access to wired Internet. This is promising in terms of Internet infrastructure transformation in educational establishments. Teachers also emphasize that they use their own ICT hardware during classes (depending on a region, it is even 30%) (Plebańska, 2017). School ICT hardware has been purchased within previous EU programmes, for example Sector Operational Programme Human Resources Development 2005-2008, so these ICT resources may not be outdated but are low-efficient, based in Windows XP, 7 or 10 operational systems and free Linux distributions. In the context of developing new ICT solutions addressed to educational sector ad requiring efficient hardware, this is a technically important aspect

The problem of insufficient availability of high-speed Internet access will be solved within next several dozen months. In 2017, as part of eliminating the gap in Internet access, the Council of Ministers decided to form the National Educational Network (OSE, OgólnopolskaSiećEdukacyjna), thanks to which school will be provided with connectivity of at least 100 Mb/s According to data by the Ministry of Digital Affairs, only about 23% of Polish schools have connectivity of 100 Mb/s or more. OSE program will be managed by Scientific and Academic Computer Network — National Research Institute (NASK, Naukowa i Akademicka Sieć Komputerowa – Państwowy Instytut Badawczy). As emphasized by representatives of the Ministry of Digital Affairs, "launching OSE program will level educational opportunities for students in Poland, in particular those loving in low-populated regions and learning in small schools, for whom access to knowledge and modern technologies is a main contributor to the increase of their educational potential" (NASK, 2017).

About half of teachers evaluate their computer laboratories as very good (14%) and good (41%). It is interesting that 75% of computer rooms are equipped with multimedia

projectors, and only 45% have multimedia boards. In most cases, teachers use ready-to-go applications. They are not so fond of developing their own programs, websites or cloud-based resources. They most often use: movies, applications, online presentations (81%), graphics (77%), games and exercises (57%), digital texts (53%), e-textbooks (38%). ICT is most often used in primary schools (Plebańska, 2017). Thus, primary schools could be the first ones to receive offers regarding latest educational products, both in line with the core curriculum and exceeding standard and known ICT solutions (Plebańska, 2017). Unfortunately, governmental solutions such as Scholaris platform and e-textbooks, despite relatively large investments from central bodies, are not very popular among teachers. This has been noticed during an audit performed by the Supreme Audit Office (NIK, Najwyższa Izba Kontroli).

Most teachers positively evaluate new technologies as a method to increase attractiveness of their classes (more than 70% say it is a good or very good way), but at the same time, only slightly more than a half believe digital technologies increase the effectiveness of learning. The vast majority of educators, use technology as a substitute for traditional teaching methods, that is, as knowledge transmission tools (e.g. by showing multimedia presentations, movies). About 42% of teachers declare they use multimedia presentations. Interactive boards are used by 27%. Online games, remote learning platforms or more advanced solutions like tablets, measuring interfaces, coding cubes and other are used very rarely. Teachers very rarely use digital content such as e-books. Pedagogues who declare they integrate ICT into learning process, do not use those solutions during IT classes only, by in almost all fields, including ethics, religion and visual arts. 40% of teachers use digital technologies at least several times a week (Plebańska, 2017).

There is also a noticeable correlation between a taught subject and use of ICT. Teachers of: mathematics, IT and technics use new technologies most frequently. IT teachers, due to the specifics and range of their subject, are not only expected to have higher competencies but also to be more active in this area. In addition to read-made materials, they should design and construct their own multimedia didactic content. Teachers of environmental sciences, geography, chemistry and physics use ICT on an average level. Physical education, foreign languages and social sciences teachers use ICT the least frequently (Baron-Polańczyk, 2015).

Teachers point out that ICT use entails a risk that students will treat classes with new media as non-compulsory and resort to other activities, not connected with given educational objectives, e.g. entertainment. Teachers are most discouraged by such the following factors that prevent integration of ICT into educational process: poor Internet access or lack of it, low quality or no hardware, outdated software, lack of funds to buy equipment and applications, no technical and methodological support, and time-consuming preparations of digital teaching resources. It is worth to point out that teachers most often learn how to use ICT during trainings (73%) that are usually present only certain options Retrieved from applications. These trainings do not include methodological

or pedagogical issues. Other sources of knowledge is self-education from the Internet (65%), peer-to-peer support (58%) or conferences (45%) (Plebańska, 2017).

The above declarations are strictly tied with opinion of students who think that more than half of schools do not use any ICT solutions in learning and teaching process. 21% of students think ICT-related tools are used during classes every day, whereas 40% say they are used several times a week. Typical lesson with new technologies involves multimedia presentations (41%) and interactive boards (27%). Every fourth student is obliged to prepare a presentation as a homework (most often in Power Point or its free substitutes) which is then presented during classes. 18% of students use their smartphones as didactic tools. The vast majority (81%) utilise only given information sources and have no possibility to create their own educational resources. In most cases, students think multimedia increase lesson effectiveness (81%) and attractiveness of classes (91%). Also, most of them (80%) say that introduction new technologies to classes increases their engagement. At the same time, they have problem with describing the most interesting lessons with ICT (Plebańska, 2017). Implementation of ICT is very schematic and does not cause lasting, model memories.

Parents are sceptical towards new technologies in didactic process. They do not trust solutions supporting effective learning. This is probably because they do not know good solutions. They associate ICT mainly with entertainment. However, they recognize the role of proven and familiar solutions, such as multimedia boards or computers. They evaluate use of tablets and smartphones less positive. Parents also emphasize the meaning on ICT in education in the context of including these solutions into the process of developing key future competencies (Plebańska, 2017).

Considering the results of a report on saturation of schools with new technologies, we need to point out that "both, very well and very poorly equipped schools participated in the study. In the first group, excellent quality hardware can be found in every or almost every classroom. Such schools are less than 10% of all studied facilities. The least equipped schools have not enough hardware to meet the needs of teachers and students, and available IT infrastructure is out-of-date and prone to failures. The number of such schools is much bigger, up to 30% of all investigated facilities" (Grynienko et al., 2013). The situation depends also on the type of school. For example, schools that specialize in programming education use much more modern hardware and applications (Strzecha, 2012). Schools gradually update their IT resources. According to NIK report, "audited schools had infrastructure necessary to teach information and communication technology: on average, there were on computer per eight students, and four interactive boards and nine multimedia projectors per school. All schools had computer laboratories used according to needs not only during computer and IT classes, but also other subjects. About 76% of teachers in audited schools had personal computers" (NIK, 2017). Unfortunately, auditors did not include qualitative aspect of the audit, that is, analysis of technical parameters of school equipment.

Despite different levels of hardware saturation, teachers most often use paid and free software with didactic materials, provided by popular publishers (for example Oxford Press, Longman, Nowa Era, WSiP, Operon). YouTube and general teacher-dedicated portals, such as Scholaris, are popular education resources (Grynienko et al., 2013). We should also mention that "the value of the book market in Poland in 2014 was PLN 2.48 billion, given the prices publishers give distributors. As for type of books, the biggest share in revenue was generated by school textbooks, and scientific and specialist publications — almost 70% of the market." The leading publishers of educational resources are: Wydawnictwo Nowa Era (annual revenue of PLN 261 million) and Wydawnictwa Szkolne i Pedagogiczne (annual revenue of PLN 243.8 million) (AnalizaRynku, 2016). Despite demographic changes, Polish education resource market is stable. However, it can be limited to some degree by intervention programmes introduced by the state, for example Digital School (Cyfrowa Szkoła) (Strycharz, 2013; Łysek, 2013; Czerski, Wawer, 2014). Considering the total investments in education, analogue solutions are still main resources used in schools.

Use of new technologies is strongly related with financial and non-tangible factors in a given school - as noticed by authors collaborating with the Cities on the Internet Association (operator of many national education projects). Material factors, namely the amounts in school budgets provided for retrofitting or percentage share of own funds necessary to participate in funding projects, are extremely important. In many cases, other material factors that limit the use of ICR are still poor quality IT equipment. However, intangible aspects of using digital education resources become equally relevant: teachers' motivation, attitude towards ICT and level of digital literacy which in some areas if insufficient to face some challenges of information society, for example digital safety (Tomczyk, Srokowski, Wąsiński, 2016).

Despite relatively unfavourable conditions of still low saturation of good quality ICT equipment and low motivation and digital literacy among teachers, teaching patterns change. Teachers more and more often recognise possibilities of multimedia or network resources, that facilitate learning. An example may be schools for Polish children living abroad, where educational objectives of curricula are realised by means of remote education tools. Due to data confidentiality, we do not know the exact number of students, but such solutions are more and more often found as model examples.

General data show that PCs can be found in 75.2% and laptops in 63% of Polish households. Most of these devices are connected with the Internet, out which 56% through broadband connections. Only 2% of computer owners have no Internet access. 9.8% have game consoles, 32% — printers, 95.7% — mobile phones out of which 53.4% are smartphones (GUS, 2017). Having children in pre-school or school age is a factor that significantly determines possession and use of new media in a family. This refers to Internet access and use of smartphones, tablets or game consoles. Over 90% of households with children have computers with Internet access (GUS, 2016). According to data gathered by

the foundation Dbam o MójZasięg, 25.7 million Poles are active Internet users, 13 million are active social network users and more than 9 million have smartphones. The percentage of smartphone users increases with age. Save for typical communication purposes, smartphones are used by young people to: use social media 70.6%, communicate with other through applications 59.2% (e.g. Messenger, Viber), listen to music 54.2%, take photos 49.4%, support learning 47%, entertainment e.g. games 45% or develop interests 32% (Dębski, 2016). This is confirmed by the analysis conducted by the Educational Research Institute, based among others on PISA results. The data indicate that "students with no access to technological advancements receive lower grades, however, those who use their computers, tablets, mobile phones or Internet excessively, are also lower in ranking" (IBE, 2014). This dependency is long discussed in Polish publications on media pedagogy. The relation is shaped as a reversed U. The more "wise", that is intuitive and intentional use of ICT, the better school results. However, the use of every didactic tool has its critical point that, when reached, leads to lowering school achievements (Potyrała, 2017).

The general data would be incomplete without references to young people — students. The majority of this group use Internet multiple times a day. About 93.4% is non stop online. Shorter and longer Internet connections to log into e-services are most often made via mobile phones. This is an important information in the context of designing software that should be purpose-build for the most popular devices. Peer-to-peer communication through media is very important for students — over 67% do it on daily basis. In the context of using personal devices for education: 16.3% use ICT to prepare for tests, 36.6% do their homework, 24.2% extend their general knowledge needed to complete school assignments, and 6.2% use e-learning platforms. ICT are used most frequently (very often and often) to learn: informatics (over 60%), foreign languages (over 31%), Polish language (over 25%). The majority of students use Wikipedia, Google, YouTube and Ściąga.pl everyday (NASK, 2017). The most popular educational websites are (from the most to the least popular): librus.pl (administrative systems for schools, supporting learning and teaching), sciaga.pl (ready-made essays), pwn.pl (educational resources), edupage.org (learning and school management supporting app), bryk.pl (ready-made school assignments).

An important aspect connected with entering educational services market is to identify where young people look for information about IT products, such as digital devices or software. The most important Internet sources are: blogs dedicated to certain technologies and recommending certain solutions (64.3%), detailed product specifications on producer's website (60.1%) and analysis of posts in specialist Internet forums (52.6%). Another important source of information about IT products are online offer repositories, for example ceneo.pl. About 47% of respondents use these platforms. For young people, advertisements are the least reliable — only 18.8% of young respondents chooses their technologies based on information found in promotional messages (Siuda et. al. 2013).

Polish school reality (curricula overloaded with content, big classes, competition) do not facilitate the individualisation of learning. Using modern technologies allows to meet the individual needs of the students and create working environment that fits the individual learning styles (Prashing, 2006). Thanks to the use of ICT in learning, students are more engaged and independent. They are more willing to perform the tasks which require technological support. Technologies motivate, provide positive stimulation and are most often associated by the students with entertainment. According to the studies, learning in such conditions is much more effective than in the traditional circumstances dominated by control and stress (Żylińska, 2013).

For many teachers, using digital resources means saving the time, both during preparation and implementation of the classes. Using different education tools, applications or platforms reduces the time needed to prepare didactic resource. Some of these solutions, for example Canva, combine several functions, thus enabling approach to the subject taught from different perspectives. Saved time may be dedicated to support the students who struggle with school failures (Instytut Nowoczesnej Edukacji, 2019). More and more methodological and teaching resources are available free of charge as e-books. Teachers may browse them easily (open educational resources, OER) and download them to their PCs. They can also connect through blogs and share their experiences in online forums. This way, the community of digital educators may integrate and grow.

Developing digital and information literacy among the students is undoubtedly the investment which will bring profits in the future. First of all, it prepares the students to participate in lifelong education, especially informal one. The ability to search for information, critically select and re-edit it is a sought-after skill in the labour market. The ability to work in an online team will be useful in almost any profession.

The analysis of the research results shows that school students are the enthusiasts of the new technologies. They can use them actively and effectively for education purposes (doing homework, searching for additional information, preparing materials – presentations, videos etc.). Teachers, in turn, even though they recognise the attractiveness of using ICT-supported teaching methods, do not necessarily believe these methods to be effective. This means that they are most likely not prepared to use ITC effectively within the formal education system. Even if they apply the new technologies, it is most often instructive (student are not involved). The research results show that teachers do not use such digital resources as applications, databases or e-books. Another barrier which hinders application of new technologies in schools is the lack of proper equipment. This is the biggest obstacle to using ICTs in the classes.

Lack of equipment and low methodical competencies of the teachers are the reasons why students acquire their digital literacy outside the school or not at all. Giving up using ICTs or using them occasionally and ineffectively during classes results in lower digital literacy among the students and, consequently, problems with their functioning in the labour market and the global information society, that is, modern Europe.

ICT for disadvantaged people in different countries & Universal Instructional Design

The terms *digital gap* and *digital divide* refer to the access to new technologies in the physical and literacy context. These groups include seniors, individuals with a lower level of education, the poor, ethnic minorities and people with disabilities (Plichta, 2017).

New technologies are a very important contributor to active social functioning of people with disabilities. The inclusive character of ICTs is noticeable in the two complementing areas: technological and social (Masłyk, Migaczewska, Żuchowska, Stojkow, 2016). Technological application of ICTs helps to level the opportunities and reduces the barriers of biological dysfunctions caused by disability. This is thanks to, for example, speech synthesisers, replacing verbal communication with written messages and other facilities removing the barriers resulting from physical limitations (including sensory) of people with disabilities. The social aspect of the new technologies is related with facilitating participation in the social life (see Barnes and Mecer, 2008).

Due to many barriers: architectural, infrastructural, communication and economic, people with disabilities are at risk of exclusion and discrimination, which means difficulties or even lack of opportunities to develop social and professional life. So far, one of the most effective activities focused on supporting activation of the disabled is the implementation of the universal design. Universal design involves planning and designing the public space in way that ensures its full availability to all its users, to the most possible extent. This idea promotes the society inclusive for all the citizens, regardless of their abilities and skills (Todys, 2013).

There may be different sources of digital divide among people with disabilities. First, individuals with reduced abilities may lack access to the latest technologies because they do not have proper devices and specialist software. They may also lack competencies which would allow them to use widely understood network functionality. In Poland, people with disabilities have reduced access to technologies as they lack the financial means to buy them. The socioeconomic status of the disabled is low, which is a serious barrier to accessing the modern technologies. People with disabilities are the group which is most stricken by poverty, what is confirmed by the so called monetary indicators of poverty. This refers to themselves and their families. Individuals with physical deficits significantly increase the risk of poverty for their families (Bartkowski, 2014). According to the research by the Central Statistical Office (2018a), families with a disabled member have much lower income than families without disabled members.

Based on the report "Diagnoza Społeczna 2013" (Social Diagnosis 2013)[14], Tomasz Masłyk and Ewa Migaczewska (2014a) developed a *Portrait of active, disabled Internet user.* The study was conducted among 26,307 respondents out of which 11% had some

[14] Since 2014, there were no studies comparing the use of ICT by people with and without disabilities.

form of disability. The authors of the report claim that only one in three persons with disability declared they use Internet (32.9%), while the percentage of Internet users among the fully-abled respondents was twice as high (67.3%). Disabled persons use Internet mainly for information and communication purposes, using web browsers and messengers. As they refer to the results of their analyses, the *Portrait's* authors say that disability creates barriers to participation not only in the physical world but also the virtual reality. Even though the Internet is the tool which allows to overcome numerous limitations related to the motor and perception (as well as mental) dysfunctions, it is not a substantial daily support for most of the disabled people. The differences in the scope of using the Internet among the people with different degree of disabilities confirm the above conclusion. The more limitations the disabled individuals face in their everyday life, the less they participate in the online community (Masłyk, Migaczewska, 2014a, 2014b).

Many online activities people with disabilities engage in are social or leisure (forums, social media) and institutional (connected with studies, work or search for information in institutions' websites). The research results indicate that the disabled rarely engage in creative activities in the cyberspace, such as website design, blog posts or development of original resources. Also, the scope of using Internet functionalities is smaller than among non-disabled users. In the "Social Diagnosis 2013" study the respondents were asked to select which of the 26 Internet functionalities have they ever or recently used. The average number of online activities performed by the fully-abled users (ever or recently) was more than 15 whereas for the disabled respondents it was 12 (see Masłyk and Migaczewska, 2014). The results of the analyses show that Polish Internet users with disabilities do not use the full potential of online network — both, to facilitate their daily functioning and in the area of fighting for equal treatment and full social inclusion. A very important fact is that disability itself (regardless of the sociodemographic characteristics) does not limit the chance to be an Internet user. Of course, lack of relation between the disability and the use of the Internet does not mean that the representatives of both categories – persons with and without disabilities – are alike in terms of the history, intensity and functionalities used.

Migaczewska and Masłyk (2014a, 2014b) noticed some significant differences when comparing the fully-abled and the disabled online users. People without disabilities spent 12.5 hours weekly online, while for the disabled users it is two hour per week less (10.4). Educational background is the factor which supports the use of the new technologies. According to Migaczewska and Masłyk (2014a), each year of education increases the chance a person will fall into the "Internet users" category by over 40%. Thus, disabled students or university graduates use the new technologies more often. Karolina Włodarczyk (2013: 34) says that one of the means to increase the low availability and, in some cases, lack of access to life-long education are ICT-based e-learning tools. Thanks to e-learning people with dysfunctions may acquire competencies in different fields while staying home, using their own, individually adjusted computer equipment

(Włodarczyk, 2013). Virtual learning environment facilitates the development of cognitive flexibility and digital agility, which are extremely important from the perspective of how the disabled people are seen by others (including other professionals). If they are digitally agile and technology literate, they are less often treated as helpless victims of exclusion (Plichta, 2013).

We can see that at present, young people in particular have the need to be constantly online regardless of the place or time of the day (or night). This need may be satisfied using smartphones or tablets with Internet access. Here too, we can notice significant disproportions between the Internet users with and without disabilities. One in three fully-abled individuals (33.7%) uses these opportunities whereas among the disabled it is one in five persons (20.8%). The users of mobile devices with Internet access are more active online: they use more functionalities available. This relation applies to both types of Internet users. The fully-abled users of mobile Internet engage in about 19 activities and those who do not have access to mobile network – little less than 13, and it is a statistically significant difference (Masłyk, Migaczewska, 2014a).

People with various disabilities may use many assistive technologies which facilitate better functioning in the society, thus not using new technologies or limited use of ICT may mean failure to realise own individual potential in the social life. People with impaired hearing may participate fully in the society thanks to e-mail messaging or online communication tools. The blind or visually impaired may overcome the barriers thanks to assistive technologies like Braille displays or screen readers (Włodarczyk, 2013). One of the solutions is the OCR (Optical Character Recognition) software to convert printed or handwritten documents into digital formats. By means of special screen readers information from the computer or smartphone screen is interpreted and communicated to its blind users. Other solution are speech synthesizers – the software to convert text into human speech. This may be done using screenshots or self-voicing applications. People with disabilities may also use individual (FM systems) and collective (induction loops) solutions to communicate messages from a microphone directly to hearing aids (Zadrożny, 2019). There are speech simulators available online. They can be accessed for free but many of them reads only limited number of signs in single entry so the text must be entered in parts (Procesor.pl, 2019). Thanks to the Internet which is free of architectural barriers, people with motor disabilities may visit numerous institutions online and handle various administrative issues from home (Włodarczyk, 2013).

There are organisations and foundations that focus on removing the barriers to ICT use. Here, it is worth to mention the activities undertaken by Polish entities from the first and third sector, aimed at digital activation of people with disabilities. The example of such activities in the public sector are the initiatives by the State Fund for the Rehabilitation of the Disabled (Państwowy Fundusz Rehabilitacji Osób Niepełnosprawnych, PFRON). For example, the activity "Customer Service System for Support Financed by PFRON" (System obsługi wsparcia finansowanego ze środków PFRON) implemented within the

Digital Poland Operational Programme for 2014-2020 serves to provide the disabled with modern technologies. In addition, PFRON offers support in acquiring digital and information literacy through trainings. The Fund also supports people with disabilities in purchasing new technologies which help them to overcome the physical barriers: speech synthesizers and other modern solutions supporting communication and mobility (*Portal informacyjny Systemu Obsługi Wsparcia finansowanego ze środków PFRON*, 2019).

The example an NGO focusing on e-inclusion of the disabled is Fundacja Aktywizacja (the Activation Foundation) which for almost 25 years has been promoting information and communication technologies and is a forerunner and expert in using ICTs to activate people with disabilities. Foundation activities focus on promoting and describing the ICT solutions useful in many areas of life, assistive technologies, tools and software for users with limited mobility or sight or hearing dysfunctions (Włodarczyk, 2013).

Other group at risk of e-exclusion are seniors. Despite the fact that, according to the Central Statistical Office (Główny Urząd Statystyczny, GUS), in 2018 computers could be found in 80% of Polish households, seniors lack sufficient IT competencies to become safe, effective and active participants of the virtual world (see GUS 2018a, Batorski, 2013; Tomczyk, 2013; Niemczyk, 2016; Gacka, 2017). According to GUS statistics (2018b), only a little more than 25% of the citizens aged 60+ use online resources on regular basis. To prevent digital divide of the elderly, the programme Digital Poland of Equal Opportunities (Polska Cyfrowa Równych Szans) was launched. Its project "Digital Lighthouse Keepers" (Cyfrowi Latarnicy) aimed at increasing digital literacy among the "digital immigrants" is carried out by the Ministry of Administration and Digitisation and the Cities in Internet Association (Stowarzyszenie Miasta w Internecie). The name refers to the lighthouse keepers who light the way for ships navigating through unknown waters, often in difficult conditions. This metaphor pictures the struggles people aged 50+ often experience as they learn to navigate the virtual (in their opinion often adverse) environment. Today, there are 2,942 certified Lighthouse Keepers of Digital Poland (*Kim są Latarnicy?,* 2019).

A very popular form of senior education in Poland are the Universities of the Third Age (U3A). Their number grew rapidly in the years 2007-2012. Developing digital literacy among seniors is a relatively new trend in the U3As' educational activity, as it is in the academic research and work. The focus on new technologies fits into the area of activities minimising the intellectual exclusion of the oldest generation (Marcinkiewicz, 2012). According to diagnoses, almost 90% of the U3As offer computer classes (Zoom na UTW, 2012). Computer courses are almost as popular as language classes (21-28% of the respondents), right after cultural and recreational activities (Urząd m.st. Warszawy, 2013). IT classes are most often part of inter-generational learning. The representatives of the young generation share their practical knowledge on the use of technologies while seniors share their life experiences with the young people. This inter-generational exchange enriches both parties and adds a new value to the knowledge developed through such dialogue (Silver code, 2018). According to the authors of the "ZOOM na UTW"

(ZOOM on U3A) report, *there is no better way to learn from one another and to use one another's life, professional or social experience than engage in different tasks together* (Gołdys, Krzyżanowska, Stec &Ostrowski, 2012:73). ICT classes are often led by amateurs (like Lighthouse Keepers of Digital Poland of Equal Opportunities) who organise workshops for adults aged 50+ together with a U3A (UTW UJ, 2019) or by students as part of their internships (Jakimowicz& Nalepa, 2012).

The report "Jak korzystamy z Internetu" (How do we use Internet) (2018) indicates that in 2017, 16% of the households in Poland had no access to virtual network. There are many more households without the Internet access if there are no children in the family. The difference is significant and amounts almost up to 30%. This results perhaps from the fact that it is the youngest family members who use Internet most frequently. The biggest group of Internet users in Poland are children aged 12-15. Among them, almost all use the Internet (97.1%) We can assume that online activities are absolutely natural for them, it is something they cannot image living without.

Manuel Castells (2009) says that Internet is not another technology gadget but innovation leading to significant social consequences. More and more, digital literacy determines individuals' multi-dimensional activity in today's society. Social inclusion is extremely important because thanks to assistive technologies and Internet access people with disabilities may fully participate in the social life, use educational resources and engage in professional activity. Thanks to the ICT development, individuals who several years ago were totally excluded from the social, vocational and digital life, have now become active in many areas.

Despite large efforts taken up by foundations and organisations towards supporting e-inclusion in Poland, there are still groups at risk of digital divide. According to Łukasz Tomczyk (2018), about 12 million Polish citizens still experiences digital gap. In addition, digital literacy of people at risk of e-exclusion is still insufficient. Failure to use ICT is less and less the result of limited Internet access – it seems that the greatest hindrance to using new technologies in daily life is the lack of motivation and sufficient competencies (which may also result from the lack of motivation). Groups which use online resources the least are seniors (in families where there are no children) and people with disabilities (intellectual disabilities in particular). Today, as new technologies determine our activity in many areas of social life, the problem of e-inclusion of these vulnerable groups has become the priority of social policy. Thanks to the activities of different organisations, associations and foundations, digital gap has reduced significantly, however, there is still much to do – not only in terms of inclusion but also regarding the increase of digital literacy among people who use Internet to a small extent.

Education for educators

The contemporary social changes caused by the rapid development of ICTs forced the shift of the existing paradigms in education (Robinson, 2013) and generated the need

of practical implementation of the assumptions of constructivism and connectivism. Teachers must be prepared to work with a new category of students for whom ICT is the natural habitat (Prensky, 2001). They must be equipped not only in skills enabling them to use ICT and e-resources (critical selection and modification) but also able to create their own digital didactic materials. Modern teacher should be: a guide, a creator and an expert in the ICT-supported didactic process (Koncepcja realizacji projektu, 2019).

Increasing teachers' competencies in the area of new technologies has become the key element of educational policy. One of the activities in this area is "Poland 2030. The third wave of modernity. Long-term National Development Strategy". Its priority is to improve the quality of human capital and the state's responsibility is to level the educational opportunities at every stage of education and improve the quality of educational services (Ministerstwo Administracji i Cyfryzacji, 2013). The activities within the second element of this strategic area – Digital Poland – include dissemination of digital and media education at every stage of formal education (increasing competencies of the teaching staff) and using digital technologies throughout the education process (Ministerstwo Administracji i Cyfryzacji, 2013). The activities are further specified as part of two strategic objectives. Objective 3 *Better access and quality* involves the following tasks: introduction of new models of educational and vocational competencies and professional career including, for example, obligatory competencies in using new technologies in teaching all subjects. Objective 5 *Creating Digital Poland* is the answer to the demand for effective system mechanisms of developing digital literacy (in formal, informal and non-formal education). It will be implemented, among others, through developing digital literacy among educators (teachers and employees in all educational and cultural institutions) and implementation of common digital education in the Polish society. This objective will also involve launching academic specialisation connected with digital education (MAiC, 2013: 94).

Activities towards the improvement of digital literacy are also one of the specific objectives of the Human Capital Development Strategy 2020. It provides for the development of digital literacy of teachers in order to increase the frequency of using interactive teaching methods and high-quality didactic e-resources, as well as equipping schools and institutions with devices enabling wide application of ICTs (The Act No. 104 of the Council of Ministers of 18 June 2013).

As part of operational programmes at the central and regional level, many projects are implemented to increase teachers' ITC literacy. One of them is the Operational Programme Digital Poland for 2014-2020. Projects financed within this programme are divided into three groups:

- planning and development of broadband infrastructure providing access to high-speed Internet
- extending the scope of public services available online
- promoting the use of Internet and improving digital literacy.

Academic units are among the institutions entitled to receive the grants (www.polskacyfrowa.gov.pl 2019).

In the years 2012-2013 the governmental programme "Digital School" (Cyfrowa szkoła) was carried out. It focused on developing teachers' and students' competencies in using the latest information technologies. It had 4 components: e-school (providing schools with proper hardware), e-student (purchasing digital devices for students), e-teacher (trainings in ICT use for 40 "e-coaches", 1,200 "e-moderators" and 19,000 e-coordinators) and e-textbooks (developing 18 free e-textbooks and 2,500 open educational resources) (Journal of Laws of 14 April 2012, Item 411).

In 2015 the Ministry of Administration and Digitisation together with the Ministry of National Education initiated the project of the National Education Network (Ogólnopolska Sieć Edukacyjna, OSE) the purpose of which is to provide schools with fast, secure and free Internet access (there are about 30,000 schools in Poland). NASK, the national research institute, is the project operator. The purpose of the project is to promote the use of new teaching tools, increase the competencies of students and teachers, and level the educational opportunities among the Polish students. We need to remember that there are still households in Poland, which lack access to the global network. First schools joined the National Education Network as from 1 September 2018. More school will join gradually until the end of 2020. The initiative was recognised by the UN agenda, International Telecommunication Union and received the WSIS Prize 2018 (https://ose.gov.pl/). In March 2019, during the II Digital Literacy Congress in Tarnów, "Tarnów Declaration for Digital Transformation of Polish Schools" was signed by the Ministry of Digitisation, the Ministry of Science and Higher Education and NASK. The declaration is open. It states, among others, that "Digital transformation of Polish schools requires support and mobilisation of many partners, organisations and institutions, which have already been active in this field. Let us join our efforts in developing an 'educational ecosystem of the National Education Network' – a natural, well communicated school environment which responds to the challenges of the 21st century and supports local initiatives and exchange of experiences. An environment that promotes innovative use of digital teaching resources and didactic methods, stimulating students' cognitive appetite" (Deklaracja 2019). The declaration addresses the issue of digital literacy among teachers: "Teachers of all subjects should constantly develop these competencies by participating in trainings providing them with practical skills which are as important as their subject knowledge. We postulate creating a system within the existing Integrated Qualifications System for recognition of the qualifications of teachers in the area of methodical and digital competencies" (Deklaracja, 2019). Simultaneously, the Ministry of National Education is carrying out another governmental programme, Active Whiteboard (Aktywna Tablica). The purpose of the programme is the development of school infrastructure and ICT literacy among students and teachers by equipping primary schools in interactive boards, projectors, speakers and interactive touchscreen monitors (www.aktywnatablica.org, 2019).

On of the regional initiatives in the area of life-long learning projects developing digital literacy among the teachers was the Digital Didactics Laboratory (Laboratorium Dydaktyki Cyfrowej, LDC) addressed to schools in Małopolskie region. The main purpose of the project was to improve the quality of teaching in the region by June 2015. The specific objectives included:

- increase teachers' competencies in digital didactics
- create conditions favouring the development of qualifications in ICT-supported teaching. The Centre for Digital Didactics is to ensure these conditions
- prepare a resource database and a contact network, which will help to create a system for the improvement of digital literacy among teachers in Małopolskie region (Laboratorium Dydaktyki Cyfrowej, 2019).

The Digital Didactics Network (Sieć Dydaktyki Cyfrowej, SDC) will be a highly effective tool to implement the postulates of popularisation of ICT-based teaching. The new system consists of the following: online information database, Centre for Digital Didactics, 4 information points, 72 Digital Teaching Specialists, Digital Education Leaders, trainings for teachers, trainings for school directors, mentoring, contests and Local ITC Excellence Groups (Grynienko, Srokowski, 2015:91-92). The project was addressed to the teachers and directors in the lower- and upper-secondary schools in Małopolskie region. The main final product was to be the Centre for Digital Didactics (Centrum Dydaktyki Cyfrowej, CDC) – the most innovative space for professional testing (didactic experiments) and development of the new model solutions based on the results obtained. At present, the Centre is located in the Centre for Professional Development of Teachers in Tarnów. It provides substantive support for the teachers and schools all over the country. In order to improve digital literacy of all the project participants and teachers interested in the initiative, an online education service was launched. It supports the non-formal life-long learning, that is, enables the exchange of teaching resources such as publications, multimedia files or presentations.

Other interesting initiative was the programme "Active Education" (Aktywna edukacja) executed by the Centre for Citizenship Education (CCE). The objective of the programme was to equip school directors and teachers in competencies necessary to integrate ICT into their work. The participants learned about the most effective methodical and organisational solutions to integrate modern equipment into teaching and learning process (Ulotka CEO, 2019). One of the activities was the "Digital Path" (Cyfrowa ścieżka) dedicated to school teams (a director and a group of teachers). It involved an online training and team meetings dedicated to the exchange of experiences, through which the participants could extend their knowledge and learn how to effectively introduce technologies to schools (CEO, 2019). The year-long online training addressed the principles of effective teaching and introducing ICT during classes. It was Retrieved from two versions to tailor it as much as possible to the functions performed by the teachers. Thus, there were courses for school coordinators and subject coordinators. The school coordinator training covered the following issues: selection and management of

equipment, and effective organisation of work. The subject coordinator course had as much as 12 versions. The organisers wanted to ensure that their content was the most possibly adequate to the specifics of the teaching methods applied for certain subjects (CEO, 2019). Coaching sessions consisted of six thematic modules, each lasting for about a month. Each module ended with practical implementation of the theory taught. Program moderators provided assistance to the teachers during the programme. One the most important expected outcomes is the initiation of collaboration between teachers in the offline and online space. This collaboration will be the key element of life-long education in this professional group. To meet the needs of certain schools, the organisers also prepared the additional offer of trainings within the "Active Education" programme. Courses IDĘ DALEJ (I keep on walking), NA SKRÓTY (Shortcuts) and IDĘ SAM (I am walking alone) complement the "Digital Path" trainings (CEO, 2014).

Improving the level of digital literacy also involves preventive activities. One of them is the programme "Bezpieczna+" (Safety+) launched by the Ministry of National Education and executed in the years 2015-2018. One of the programme components is dedicated to safe navigation in the cyberspace (Bezpieczna+, 2019). The media prevention activities were implemented within two projects: "Cybernauts" (the institution responsible was the Modern Poland Foundation) and "Digitally Safe" (Cyfrowo Bezpieczni) (Cities in Internet Association from Tarnów). Their purpose was to improve digital literacy and raise the awareness among the stakeholders of education process taking place in media environment (Tomczyk, 2017:226). Within the first project, a diagnosis of the level of literacy regarding safe use of ICT among students, teachers and parents was conducted. The results helped to design trainings for each of the investigated groups and create a repository of educational resources on digital safety. The repository is the first catalogue of this type (FNP, 2017). The "Digitally Safe" project involved organisation of school events dedicated to digital safety, during which workshops for students and meetings with teachers and parents were held. 2,200 mentors of digital safety (one in every school) received methodical supervision. Another element of the project was the contest titled "We are digitally safe!". The rewards were mobile digital laboratories and the participating schools organised original classes dedicated to digital safety. The project also involved launching a special consultation point for school directors, teachers and parents, and a series of national scientific conferences (Tomczyk, 2017). The programmes presented above have contributed significantly to the paradigm shift in media pedagogy (Tomczyk, Wąsiński, 2017).

Digital literacy increase is the key element of teacher training standards. The Polish Information Processing Society (Polskie Towarzystwo Informatyczne, PTI) supervised the development of teacher training standards in the area of ICT. The standards combine two complementing trends in using ICT in education: integration of technologies with different fields of education and using computers for educational purposes. A special team also developed the standards for preparing teachers to teach separate IT classes, designed a training curriculum and criteria and tracks for applying for a didactic computer

skills certificate (PTI, 2019). The standards are an important reference point during designing teacher training curricula in universities and teacher professional development frameworks. The curricula list the ability to use modern IT as one of the necessary competencies. These competencies can be developed during dedicated academic courses like: information technology, media in education or modern technologies in education and counselling. They are taught during both, first (bachelor's) and second (master's) cycle.

The paper presents the most important initiatives in Poland, dedicated to the improvement of digital literacy and media prevention. Apart from the above mentioned activities, there are many other regional and local initiatives.

Challenges and use of technological innovation

Digital storytelling

Digital storytelling (DS) has developed in Poland thanks to, among others, the availability of free multimedia editing software (www.dobreprogramy.pl, www.instalki.pl, www.komputerswiat.pl) and the growth of the level of technical skills connected with online activity. More and more often, Poles use YouTube channel to communicate with the networked community, sharing amateur and professional materials. First mentions about this form of media communication were published in Historia i Media (History and Media) website http://historiaimedia.org/. The author of the text described the workshops organised in the Centre „Brama Grodzka – Teatr NN", which referred to Digital Storytelling. He introduced the definition and reflected on the usefulness of this form of communication (Wilkowski, 2009). With time, DS has become a successful tool used in Polish formal and informal education. This form enables introduction of new content, synthesis of large parts of materials, conduction of qualitative studies, gaining experience and new competencies in using digital communication tools or recognition of students' talents (Monte Christo, 2014).

In 2013, the Ad Hoc Foundation from Warsaw executed a project financed from the Civic Initiatives Found (Fundusz Inicjatyw Obywatelskich, FIO), aimed at supporting NGOs in the following areas:

- searching for ever more effective and innovative methods of work with the beneficiaries
- improving the competencies in ICT use.

The objective was the systematisation of knowledge and experiences, as well as training special educators who would be capable of *using various forms of digital narrative, according to the context, target group and objectives of activities* (ADHOC, 2019). The final product of the project was a textbook available off- and online and a training (5-day workshop) in combining the narrative and digital techniques. The evaluation of the learning outcomes involved preparation and production of original scenarios of classes using digital storytelling. The textbook titled "Digital Storytelling. Educator's textbook" covers the theoretical, practical, technical and methodological issues related to the application of digital

narratives. The valuable component is the presentation of good practices, case studies and comprehensive list of publications and online resources (ADHOC, 2019). The textbook is available at https://ec.europa.eu/. Other projects are regional or local.

As part of the EU project "Valuing All Languages to Unlock Europe" (VALUE), the University of Social Sciences in Łodź organised a training and workshops for teachers in using Digital Storytelling in intercultural/multilingual education (SAN, 2019). The final product was an e-publication in PDF. Unfortunately, readers who are not familiar with the issues presented therein, may find it hard to comprehend.

Trainings in this area are also carried out by other organisations, for example the New Media Academy (Akademia Nowych Mediów). The trainings are online and free of charge, and participants receive confirmation of the competencies obtained after submitting an assignment (narrative). The training consists of 6 parts: explanation of the term, presentation of the narrative creation process, guidance and tips for organisers, case study analyses, assignments and external resource database (Akademia Nowych Mediów, 2019). Training offers can be also found in the Education Centre EST website. They are addressed to teachers of different specialisations, trainers, educators, occupational therapy instructors, therapists, teachers in various care institutions, culture animators, volunteers and employees of organisations engaged in adult education. Teaching materials are archived in an online platform (www.artescommunity.eu/storytelling). For foreign resources, users can use the "Polish subtitles" option. The platform is part of the project T&D Stories – Theatre and Digital Storytelling for Teaching and Training Development co-financed by the European Union within Erasmus+ programme. The project coordinator is the Bielsko Artistic Association Grodzki Theatre, the partners are: FondazioneNazionale Carlo Collodi (Italy), DúnLaoghaireInstitute of Art, Design and Technology, (Ireland) Alþjóðastofan/Intercultural Centre, (Iceland), Education Centre EST, (Poland) (TDStories, 2019).

The online resources include different types of education portals (e.g. media education, media-based school) containing ready scenarios using this narrative form or PDF textbooks about its application in school practice.

The KARTA Centre represents the Polish social archives and its role is to provide free tools and expertise to archivists and promote bottom-up independent archiving initiatives. The centre has published a textbook "Digital storytelling – why create digital stories based on archive collections. Tools – technologies – inspirations". The document describes different types of presentations and Digital storytelling tools (Archiwa społeczne, 2019).

Several key projects in Poland targeted young people.

A project worth mentioning is the one implemented by the Association of Creative Initiatives "ę" (Towarzystwo Inicjatyw Twórczych "ę") and Evens Foundation. The project named Praga.Lab http://pragalab.e.org.pl/w was carried out as part of the "Media" programme by Evens Foundation and was addressed to the young people (13-18 years old). The teenagers took part in a workshop held in Warsaw district Praga, and created a story about their neighbourhood using new media (photos, stop motion, photocasts) (2019).

In 2011 in Gdańsk, Orange Academy launched the project "Films and pixels. Visual Education", which combined visual and cultural education with search for local identity. Young people aged 12-18 prepared film and photo materials (Platforma kultury, 2019).

The educational project organised by the Centre for Citizenship Education titled "Filmowe pogwarki" (Movie chats) also targeted this age group. It aimed at discovering local language traditions and expanding the knowledge about local folk culture (legends, tales, songs, history of places and rituals). The project involved a series of workshops held in public libraries all over the country. The project blog blogiceo.nq.pl/filmowe pogwarki was launched, becoming the platform for communication between the participants and experts and presentation of their work (Stowarzyszenie, 2019).

Other similar project was called "The Film Collection of Borderland Fairy Tales" (Kolekcja Filmowa Opowieści Pogranicza), by the Borderland Foundation (Fundacja Pogranicze). The goal of it was: *to create an environment for creative cooperation of children and youth from different national, cultural and religious backgrounds.* It resulted with the collection of stop-motion animations. The collection is Retrieved from the online Polish film database (FilmPolski.pl, 2019).

Teachers and students in Wrocław took part in the project "The Stories of the Displaced". The goal of the initiative was to record "the monuments of the spoken word" of people displaced after the II World War from the East to Lower Silesia region (Podręcznik, 2019).

Poland has quite numerous Digital Storytelling resources. The Oral History Archive of the Karta Centre is the biggest collection of biographical relations from the 20th century. It consists of over 4 thousand audio recordings, 100 videos and other historical testimonies. More information can be found at: http://www.audiohistoria.pl.

The above mentioned projects are mostly local. There are no nation-wide initiatives addressed to wider groups of beneficiaries Workshops organised within the certain projects do not last long and thus, the topics may be covered only to some, limited extent. Trainings are free but they lack effective promotion. They are advertised on the organisers' websites which are not visited by many ordinary Internet users.

We lack conferences and seminars to share the insights, experiences and good practices. Digital Storytelling is only discussed during single presentations. In 2017, Adam Mickiewicz Institute organised the Digital Cultures conference during which Polish authors and producers met with culture managers from abroad. The program of the conference addressed four areas of digital activity: computer games, immersive storytelling, digital archives and modern museology. The meetings are now cyclic and are the platform for forming international partnerships and promoting Polish cultural achievements. Since 2015, the Institute develops the area of digital culture and supports Polish artists who operate at the juncture of digital technology and art (IAM, 2019). There are also single events, for example meetings with foreign experts.

To summarise, Digital Storytelling has been popularised in a rather narrow scope, thanks to the efforts of single media education leaders. It has its advocates among the highly-competent teachers and educators. Others are not familiar with this method or do not know how to use it. Surely, there is a need for more reliable methodological and didactic resources and trainings addressed to a wider audience.

Blockchain

This technology is used mainly in the business sector. Polish media deemed 2018 the blockchain year. In December 2018 Fintech Committee of the Polish Chamber of Information Technology and Telecommunications published the report "Blockchain in Poland Opportunities and applications" edited by Marcin Chruściel. The report presents business implementation of the blockchain system. It shows the possible applications, analyses business results and provides recommendations. The report was developed by experts who use this technology in practice and was published to provide *a reliable description of the technology so that blockchain is no longer present only as newspaper and Internet headlines and becomes one of the projects that bring transformation in many business areas (Comparic.pl, 2018).* Unfortunately, so far blockchain has not been widely used in the Polish public sector.

The Ministries of Development, Digitisation, Finances, Infrastructure and National Education have introduced a joint programme "From paper to digital Poland" (Od papierowej do cyfrowej Polski) aimed at the development of e-state, building awareness of the possible applications of blockchain and development of thedigitall currency exchange markets (Dudek, 2017). At present, there are 9 working tracks: "Digital Public Services", "E-reporting", "Distributed Registers", "e-Transportation, e-Flows", "Development of Cashless Payments", "e-Invoice, e-Receipt", "e-Teaching", "Artificial Intelligence" and "Internet of Things". The tracks "Digital Identity", "IT Architecture", "National Framework", "e-Donations and e-Benefits", "e-Health" and "Cyber Security" were completed or changed their formula (Ministerstwo Cyfryzacji, 2019). In 2018 the Chamber of Blockchain and New Technologies was established. One of its strategic objectives is education of society and institutions.

One of the important initiatives in Poland is the Blockchain Technology Centre operating by the Lazarski University (it was the first research and education unit in the Central-Eastern Europe). Its mission is to supply the market with the necessary interdisciplinary knowledge about the blockchain technology and obtain grants. Its activity covers four areas: economics and finances; law and regulations; security and information technologies. The Lazarski University also launched postgraduate studies in legal issues related to this technology (Uczelnia Łazarskiego, 2019).

Polish administration gradually implements the solutions supporting secure online processing of various administrative affairs, however, there is still much to be done.

In the education sector, blockchain technology enables *storing digital certificates and signatures, thus ensuring secure and open platform for cooperation and access to*

educational resources (Dudek, 2017:60). Compared to other countries, Poland has little experience in using this technology in education.

A Polish-Canadian company Educhain developed new solutions for institutions to streamline instant issuance and verification of digital documents. At present, in Dubai, the company has been introducing the world's biggest pilot project. Students and graduates will be able to generate blockchain-enabled documents from academic systems and add them to their personalised "Academic Passport" (Kopański, 2018).

Polish universities use electronic administration, however digital documents are not always recognised as official. They are not properly secured either. In order to reduce the fairly common practice of producing false university diploma, Polish Accelerator of Blockchain Technology has been introducing the Dokuchain project (http://www.dokuchain.com/). The tool is dedicated in the first place to universities but due its agility, it can serve in many other applications. The advantage of the tool is that is can be integrated with the existing systems (Akcelerator.tech, 2019).

The above mentioned initiatives are just a drop in the ocean of needs, especially in the education sector. Digitisation of schools and universities generates the need to deploy modern technologies, in particular those ensuring safety of all participants of the education process. Fast user identification and document validation will surely streamline the functioning of the whole system. Activities promoting the development of new solutions and improvement of literacy of Polish citizens in using these technologies are the strategic objective for the next years.

So far, implementation of blockchain technology in education in Poland is at the pilot or testing stage. What is noticeable, is the widening gap between the willingness to apply the distributed database technologies and the actual scope of deployment of these applications (Dudek, 2017: 64). Experts notice that implementation of blockchain technology is necessary for the development of education in the 21st century and a warrant of open and transparent education system. First of all, a wide scope of activities should be undertaken to raise the awareness of the social benefits and potential of this technology (Dudek, 2017) among the education authorities and institutions responsible for its implementation within the education sector. All solutions should be promoted already from the very initial stage of their development.

Global sharing pedagogy

Universities are usually the main computer nodes. Computer networks may be local (several buildings) or global (world wide computer network). Most often, universities provide access to their open repositories of scientific publications. These networks serve to support the exchange of intellectual achievements between the users. Sometimes, universities offer shareware applications which require paid subscriptions after the free trial period. They also provide access to their libraries.

According to the Webometrics Ranking (Ranking Web) by CSIC, which serves mainly to promote the so called Open Access, the best Polish university (University of Warsaw) was located at 349 position among over 24,000 investigated institutions. The Jagiellonian University was 387 in the ranking whereas Warsaw University of Technology was 436. These results should mobilise Polish academic centres to expand their online presence. Poland faces many challenges, such as:

- university authorities should define the strategy of online presence of institutions and individual staff members
- universities should ensure professional management of their e-marketing ecosystem
- data repository (books, papers) development and management should be the top priority
- academic staff members should be obliged to active contribution to their profiles in Google Scholar, ResearchGate, Wikipedia, Academia, personal websites etc.
- the role of virtual space in building school status in every field should be strengthened (Mazur, 2017).

Only a small group of ICT enthusiasts and teachers associated in specialist groups like the Superteachers, uses selected components of global sharing pedagogy. Guidebooks on open educational resources translated from English list some Polish (still very few) and global repositories with direct links to the materials (Pędzich, 2011). We still lack Polish initiatives and practical materials within the global sparing pedagogy.

The most important questions to deal with in the nearest future are the transformation of awareness of Polish citizens and a thorough, accurate diagnosis of needs in this regard. The next step is a complex promotion of the good practices from other countries. For typical Internet users, specific solutions and opportunity to test them are the most convincing.

Business aspect of ICT in education and inclusion in Poland

Average spend per student from the state budget is little less than PLN 6,000. The biggest subsidy per student is given to primary schools — over PLN 8,000. 42% of the total amount is teachers remuneration, the rest are investments, renovations and social expenditures (Sztanderska, 2013). Within the next years, there will be more programs supporting families with school-age children. The key element of social support is the continuation of 500+ programme (PLN 500 of monthly support for each children in a family, starting with second child). The government also plans to introduce other solutions such as school starter kits (PLN 300). The bigger school, the bigger opportunities to invest in innovative didactic tools. Except traditional solutions, connected with the so called educational-financial calculator per student, there are many programmes, financed mostly from the EU funds, that support technical retrofitting of schools. However, it is worth to mention some insight found in the report by the Polish Teachers' Union (Związek Nauczycielstwa Polskiego), according to which "annual expenses per student according to purchasing power at

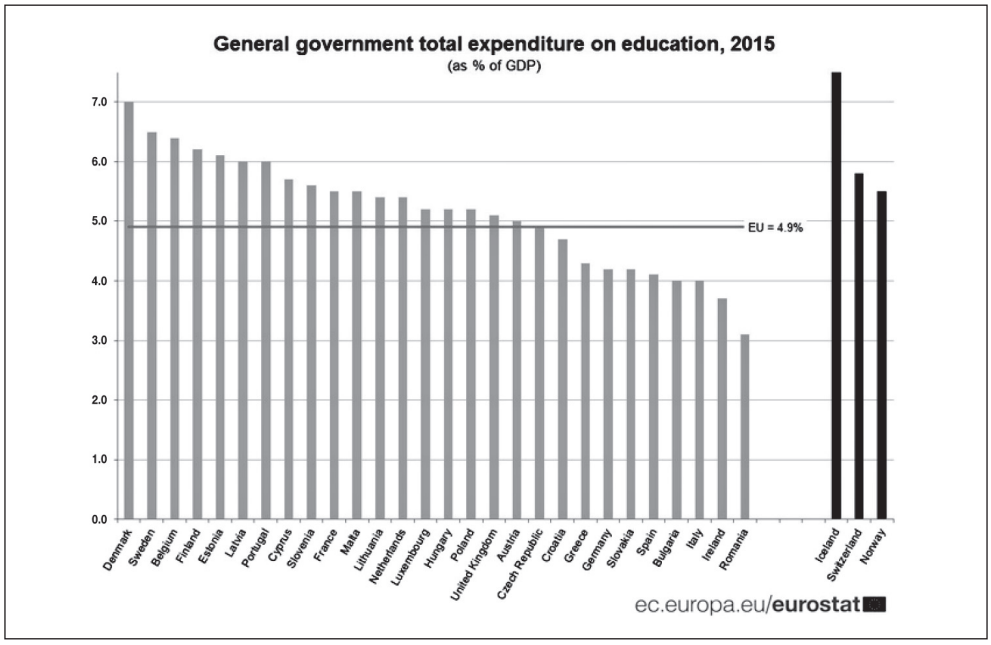
all education levels in Poland mount up to USD 6948 PPP. This locates out country in the lower part of the ranking, below the OECD (USD 9760 PPP) and EU average (USD 9908 PPP) (Jakubowski, Wiśniewski, 2018). On the one hand, Poland is found near the bottom of the list, but considering the dynamics of economic growth, measured, among others, by GDP, or the growth of educational service market, our country has potential to increase its investment share. This assumption is supported, for example, by programs dedicated to upgrade technical infrastructure in schools. The vast majority of investments in ICT are made through programmes like: Human Capital Operational Programme (covering up to 100% of all expenses), Regional Operational Programmes, Digital Poland Programme, Operational Programme Knowledge Education Development or Erasmus+.

For example, in 2012-2013, the Ministry of National Education spent PLN 50 million for additional school equipment and improving digital literacy within the program Digital School. Another PLN 11 million was provided as additional support for the local government institutions. Project "E-podręczniki do kształceniaogólnego" (E-textbooks for general education) cost almost PLN 50 million. It involved production of 62 electronic textbooks which are now out-of-date due to already mentioned recent changes in education system (phasing out of the lower secondary level) (NIK, 2017). At present, another programme called "Aktywnatablica" (Active Board) is being implemented, that focuses on technical equipping schools in devices like interactive boards. Total budged for this program for 2017-2019 amounts up to PLN 279,428,000. It will be covered in 80% from the state budget and at least 20% from local funds (MEN, 2017). In terms of scale and budget, it is one of unprecedented national projects. Centrally managed programmes set the pace for modernisation of Polish schools through digitisation.

Expenditures on education are not only subsidies granted by the state, EU or educational programmes and other intervention initiatives, e.g. trainings, but they also include cost of education covered from family budgets.The government plans further increase of systemic funds for equipping schools. Investments continued within the programmes implemented in the years 2014-2020 are financed from Operational Programme Knowledge Education Development and Regional Operational Programmes. School digitisation programmes are currently financed from centrally managed programmes. For example, connecting one school to fast Internet is PLN 8,111 net per access point, whereas internal installation, including Wi-Fi access points, costs PLN 3,500 net. The national project of the Ministry of Digital Affairs provides 15 thousand schools with connectivity of at least 100 Mb/s (Woźny, 2017). These schools will soon have efficient infrastructure that will enable further investments in software solutions.

Despite low general values in national perspective, state institutions do not spent little on education. In Poland, this factor amounts up to 5% of GDP. In general, the EU countries spent 4.9% of their Gross Domestic Product on education. In 2017 Bloomberg report Poland was ranked as 22. in the world, one position higher than last year. As for amounts spent on education per citizen, we are near the bottom of European list.

Average EU expenditure is EUR 1.4 thousand per capita. In Poland, it is EUR 584 annually. This results mainly from the GDP value (Frączyk, 2017). In this area also, the trends are promising for Poland — expenses on education grew slightly but regularly. Despite relatively low GDP comparing to other EU states, Poland spent a lot on education. When we include costs supporting formal education incurred by parents or guardians, education becomes one of the priorities in the society.



While analysing the issue of ICT in education, it is worth to remember that electronic devices market in Poland is already worth almost EUR 9 billion. Each year, it grows by at least few percent, sometimes even faster thanks to, for example, social programs like 500+. Consumers want to buy hardware and regularly spend more on it. As for average amounts spent on electronic goods per capita, we are at the end of Europe's tail, spending EUR 230 annually. In addition, it is worth to remember that Polish market is one of the cheapest regarding average prices of equipment (Mazurkiewicz, 2017). Most of it is purchased once every few years — in case of laptops or tablets, whereas mobile phones are mostly purchased as part of subscription agreement with mobile operators who include cost of the device into their monthly invoices. However, experts agree that electronic market in Poland is developing noticeably, because during the last decade expenditure on the purchase of electronic equipment increased by almost a half.

National recommendation to SELI project

At present, Poland is at the stage of intense implementation of ICT into educational processes. The outcomes are not only schools equipped with IT hardware (of different quality) but, first of all, the number of central projects and programmes increasing the scope and frequency of ICT usage. There are also many debates (conferences, expert meetings) related to the analysis of the positive and negative consequences of ICT implementation into the school life as well as discussions over the styles of ICT use among children and youth. Thus, we can say that the representatives of Polish school system, regardless of the level of education, are more and more aware of the possibilities digital media can offer, and consider both, the risk paradigm and the opportunities paradigm in their analyses. Improving digital literacy among the main stakeholders happens in many dimensions, mainly thank to external sources of financing (programmes co-financed from the structural funds to increase the level of human capital). These multi-level, complex training activities carried out during the last decade show the potential and opportunities of applying ICT in education. The process is also supported through regional conferences and comprehensive activities performed by NGOs, methodical centres or self-learning groups. Computerisation is a well established process in Polish education, a proof of which may be the electronic journals that in many schools have replaced paper systems of recording grades and frequency. This optimistic vision should be completed with several information about the negative outcomes of ICT implementation in schools. First, teachers often underestimate the potential of the new technologies, and their knowledge and attitudes vary. Failure to use ICT in a constructive way often results from poor infrastructure (old equipment, slow connection) and well-established teaching routines. At the same time, we need to emphasise that students of pedagogical directions have the opportunity to familiarise themselves with modern IT solutions which support learning and teaching during their academic training. In this context, a particular focus should be on the pedagogical faculties which should have modern IT laboratories where future teachers will improve their digital literacy to be able to respond to the challenges of the developing information society. A special reflection should also be given to the diagnosis of the level of digital literacy among teachers and pedagogy students in relation to both, technical use of the digital media and understanding the mechanisms of media influence of human behaviours. Polish media pedagogy is a sub discipline of the social (education) sciences and has been changing dynamically along with the emerging opportunities and threats of the digital world and intense development of IT infrastructures in schools.

Solutions designed within the SELI platform may turn out to be particularly useful for future teachers who – by participating in modern e-learning courses – will improve their digital literacy. Platforms like SELI enable introduction of additional content to academic curricula such as information technology or media in education. The important aspect of this process is the development trainings which will meet the needs of Polish

education system, with relevant content addressing the real challenges. When designing the platform, the diverse level of digital literacy among teachers and university students should be taken into consideration. The platform resources should be Retrieved from Polish, what will make them more useful and accessible to a wider audience.

In the context of e-inclusion, trainings available on the SELI platform may be of use for NGO, U3A or senior club educators who are not thoroughly prepared to teach adults and seniors. Many e-inclusion trainers base on their own didactic experience obtained outside the adult education institutions, and have no through methodological background in andragogy. Digital literacy coaches are often teachers who are prepared to work with children but have no methodological training based on andragogical or geragogical solutions. SELI platform provides the opportunity to increase the level of digital literacy in this group – educators in U3As, senior clubs or human capital development projects. Such courses may utilise the proven and well established Polish theoretical and methodological solutions developed within the didactic, scientific and academic projects. When generating these resources, we should also ensure they are practical and multimedia-based. The platform should be: innovative, practical and easily accessible. It should be the response to the challenges and needs related to the existing and future stages of e-inclusion.

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ICT IN LEARNING AND INCLUSION – TURKEY

Abstract: This chapter consists of preliminary information as part of need analysis of SELI project based on national context in Turkey. First of all we explain general interest in ICT integration in the field of education in Turkey. Later we discuss use of ICT in terms of broader concept of social inclusion rather than technical integration by giving examples of growing interest in workshop based co-creative, collaborative Digital Storytelling and sharing current situation in Turkey about blockchain which is an innovative term used in SELI project. Finally we share challenges, recommendations for our consortium as well as market size of education in Turkey for development of business aspect of SELI project.

Keywords: ICT, learning, inclusion, Turkey

ICT IN EDUCATION GENERAL INFORMATION

Technology integration is increasingly considered as the integration of information and communication technologies in the literature. However, the differences in the definition of the integration process are noteworthy. Although there is no common definition in information and communication technology (ICT) integration in education in the

literature, researchers generally consider ICT integration as the teacher's use of all kinds of technology in order to increase student success.

In Turkey, there has been an intense effort to disseminate technology for promotion of education for a long time. While early stages of this efforts can be defined as transformation from blackboard to one computer in each school, later target turned out to achieve providing a computer in each classroom. Fundamental Education Project funded by World Bank had an important role for transformation from blackboard to one computer in each school between 1998-2004. Later stage which meant to provide a computer to each classroom is an ongoing project called Movement of Enhancing Opportunities and Improving Technology (FATİH) by Ministry of National Education(MoNE)

Main principles of FATİH Project defined by MoNE are as follows:

- Accessibility: Offering service anywhere regardless of time and tools;
- Productivity: Providing target-oriented and more productive environments and subjects for development;
- Equality (Equal Opportunities) : Enabling all users to access the best service;
- Measurability: Providing accurate measurements of the process and results and providing feedback accordingly for a better assessment of the development;
- Quality: Enhancing the quality of education in a measurable way. FATIH Project will fund services such as providing hardware and broadband internet to all classrooms, providing e-content, establishing platforms for the participation of teachers to IT, and facilitation of the other activities including project implementation support.

Specific goals for FATIH project are to provide VPN-Broadband Internet Access, Infrastructure, High Speed Access for every school and Interactive Board, Wired/Wireless Internet Access for every classroom.

There are also various researches conducted about technology integration in Education. Yildirim (2007) has examined similarities and differences in Turkey and in EU member countries in terms of Information Communication Technology use among teacher education and primary schools training programs. The results of the research shows that there is an increasing importance of ICT integration both in Turkey and in EU member countries. Varış (2012) investigated 459 teachers' information technology literacy levels in Ankara province. According to the results of the research, primary school teachers frequently use their ICTs in the past three years. Primary school teachers stated that they use ICT with the aim of teaching. Teachers also stated that they use ICT for professional development. It has been found that teachers who use ICT frequently have higher digital literacy than other teachers. Ministry of National Education trains teachers for their own professional development in integrating ICT to improve their teaching activities and offer productive learning environment through creative designs. Since the beginning of the 2000s, ICT has gradually entered into life and education. One of the best indicator is the Movement of Enhancing Opportunities and Improving Technology (FATİH) Project which is launched

by Ministry of National Education, in Turkey. It is aimed to ensure that every student has the best education, the highest quality educational content and equal opportunity in education, the FATIH Project is considered to be the largest and most comprehensive training movement in the world, in terms of use of technology in education. Within the scope of the FATIH project, the Ministry of National Education aimed to finance the supply of equipment to school classrooms, broadband internet to all classrooms, e-content for the courses, the integration of teachers into ICT and the establishment of web platforms for content development and the implementation of activities including project implementation support. For this purpose, classrooms were equipped with smart boards and the tablet computers were distributed to students. Then, teachers were given in-service training on how to use these technologies. Çukurbaşı et al. (2016) examined students' beliefs and attitudes about the tablet computer and smartboard researched by using technology acceptance model. As a result of the research, they found out that the acceptance of the educational usage of the tablet computers in the FATIH Project is adversely developed due to the limitations such as internet access of tablet computers, the limitations (such as the decline in face-to-face communication) and other negative situations in the course of the tablet computers given to the students. Another study by Şad and Nalçacı (2015) aimed to determine the perceptions of teacher candidates for general information and communication technologies (ICT) required by the teaching profession. A total of 409 pre-service teachers from 11 different programs were included in the study. As a result, it was seen that the pre-service teachers generally perceived their level of ICT high enough for teaching profession. Saygıner (2016) evaluated the perceptions of pre-service teachers about computer proficiency levels and the use of technology in education in terms of various variables. 252 4th grade students studying at the Faculty of Education of Mustafa Kemal University participated in the study. As a result of the research, there was no significant difference in terms of computer competence and have a moderate level of competence in different departments. The weakest areas of students has been determined as database management and web page preparation. It was observed that the computer competence of men was higher than women and those who have computer with internet access showed higher computer competence than those of non-computer users. In addition, it was determined that there was a weak and positive relationship between technology proficiency levels and perception scores for use of technology in education. The universities have important duties supporting the courses with technological tools and practices for the creation of rich learning content in educational environments. In this context, it can be said that the training of the students who are suitable for the modern world can only be possible with the teachers who apply appropriate educational methods. In this respect, education faculties need to make teacher candidates equipped with the necessary knowledge and skills in terms of technology. Educational Informatics Network(EBA) is another free of charge online social education platform which includes many educational services, for students and teachers provided by Ministry of Education. In 2015-2016 academic year, the EBA system was used by 10 million primary and

secondary school students. EBA includes sources in the form of video narration, as well as sources in text, sound and image. File uploading and hosting, organizing competitions, lecturing at different levels, making announcements and making sharing by users are some of the features that enrich the EBA system. Different studies about EBA can be reached in the literature. In a study conducted by Tüysüz and Çümen (2016), students stated that they had problems such as videos are not being opened, being disconnected from the website or resetting the scores. In a study, it was found that the students think that the EBA system is not sufficient in terms of education and that it is weak in terms of having educational content. In addition, students stated that they did not visit EBA frequently because it was difficult to upload content to EBA and it was ineffective in attracting their attention. In the study, conducted by Ateş, Çerçi and Derman (2015), researchers found out that the videos in EBA was not equal in terms of distribution of videos to classes, the videos were insufficient in terms of time, the number of views was low, and some of these videos were not suitable for the grade levels. Bolat (2016) found that EBA can be used for education in flipped learning classes. Tutar (2015), found out that teachers have not enough information about EBA and they rarely use the EBA. Similarly Alabay (2015), concluded that secondary education teachers don't use EBA sufficiently during their classes.

Çoban et al. (2017) conducted a study to evaluate teacher training courses which made as part of FATIH project and aimed to design a model for future training courses. The research was conducted with mixed method and invoved 3958 teachers. As a part of the research, following results were found out;

1. It was found that the teachers who participated in FATIH Project trainings had a medium level of internet and computer use. Teachers mostly used the interactive board among the hardwares of FATIH project, and they mostly participated interactive classroom management education among training courses while they rarely participated in thematic trainings.
2. According to the examination conducted, it is found out that the teachers who are educated have the highest level of awareness about using the internet safely. However, teachers generally have difficulty in using hardwares, designing materials, installing software on the interactive board and mostly technical issues. In addition teachers found EBA as inadequate and complex during the implementation of courses; e-contents were found to be both quantitative and qualitatively insufficient.
3. IT facilitator teachers who provided training as part of FATIH Project trainings, were found to be sufficient. However, it is stated that the internet and infrastructure of the environments where education is provided is not suitable for the training of FATİH Project. In particular, classes allocated for education in schools and institutes were found not to be in an ergonomic structure and there were no suitable environments for classroom interaction.
4. It is seen that the heterogeneity of teachers who participated in FATİH Project trainings negatively affected the quality of education. Therefore, it is very important to

determine the participants according to the criteria such as branch, age and computer literacy levels.

5. It was observed that there was no effective monitoring and evaluation mechanism before during, and after the trainings. This situation poses a problem in terms of defining effectiveness of the trainings given to teachers and how if they use technology in education. As a result of this, it was revealed that an effective measurement and evaluation mechanism should be established before, during and after the training.
6. In the study, it was emphasized that the teachers were demotivated to participate in the trainings.
7. Within the scope of FATIH Project, trainings should be encouraged to attract teachers' attention. In addition, there is no coordination between Ministry departments, Council of Higher Education and universities in terms of technology use in education. It was determined that this lack of coordination caused problems within the scope of FATİH Project

ICT for disadvantaged people in different countries & Universal Instructional Design

According to Tanja Dreher the most significant exclusion is the fact that most people are not producers of media (Dreher, 2010). We can't simply say that some of the individuals just prefer to consume digital media but perhaps they do not have the skills to produce their media. It is obvious that those who can't produce the digital content doesn't have the chance to be heard and actively participate in public sphere. Therefore, disadvantaged groups who are vulnerable to digital exclusion should be given a chance to share their stories with public in order to allow representation of different points of views for producing comprehensive solutions in the society. Burgess(2006) reminds "digital divide" which is based on hard access to ICT has shifted to a concern around social inclusion and the unevenness of access to "voice" in the global media space by taking note from Warschauer (Warschauer,2003). Burgess(2006) also argues that the uses of new media have ethical and methodological implications for cultural studies, highlighting some of the discipline's persistent and unresolved tensions around popular culture, cultural agency and cultural value. Based on these arguments she uses the example of digital storytelling to speculate about the democratic potential of a participatory cultural studies approach to what she calls "vernacular creativity". As a workshop-based, facilitated practice digital storytelling workshops provide the ordinary people to tell their stories, formulating them into amateur micro-documentaries to be circulated in their own online and offline networks as well as institutional environments. Poletti(2011) analyses the role of digital storytelling in diversifying the voices in the public sphere. She particularly points out that digital storytelling produces texts which focus on affective connection with the audience. She highlights this role of digital storytelling contributes to

prevalence of intimacy and affect in the construction of contemporary citizenship. Rossiter and Garcia (2010) notes that Digital storytelling(DST) has become an emerging pedagogical tool for educators from many fields working with students of all ages including educational backgrounds and ethnicities.

Digital storytelling(DST) which is a participatory process can guide quality education which contributes solutions to problems and empower individuals to shift public opinion and policies on issues such accessibility, integration of differences, fairness of employment practices, participation in decision making. DST is based on narrative tradition and also enhanced by the multidimensionality of digital context. Rossiter and Garcia (2010) highlights that digital stories can be employed in different ways by adopting from Rossiter and Clark (2007)'s earlier work which they identified three general areas of narrative application in teaching and learning.

The first way is the use of stories in the classroom to illustrate content and underscore particular points. In this way of DST, educators are presenting content by telling with a digital story, students are consumers of what is told from one source. The second narrative application is the process of "storying" the curriculum. That is, not only do teachers tell stories about the content, but also present content through their pedagogical choices. Educators construct a narrative of the content, a curricular story. This can involve simulations oıf a digital story. Role playing games which allow students to manage the situation they are involved in can be given as examples to this type of way of using DST. The another way is autobiographical learning, or helping the learner to make autobiographical connections with the content. Educators facilitates stories owned by students. Students are actively involved as designers and producers. In our educational context we are focusing on having positive impact on pre-service and in-service teachers learning and professional development, therefore we use DST as an empowerment tool to allow them to reflect on their own experiences and then construct their stories based on their own specific context. In this way we can help teachers to take constructive action for inclusive educational transformation. Therefore we use the third way of narrative application in DST.

After ensuring which way of DST we focus on, it is also important to create link with the educational theories. The richness of DST allows us discuss it's implementation through lenses of different theoretical frameworks in education such as experiential learning, situated learning, social constructivism and critical pedagogy.

As an example of experimental learning that has emphasis on the process whereby knowledge is created through the transformation of experience Kolb(1984) coleborne and Bliss used DST in history classes and evaluated the potential in three ways. First, as a way of building group rapport through emotional exchange and sharing ideas; second, as a way of learning a new digital tool for classroom learning; and third, as a site for making public histories. Coleborne and Bliss (2011) suggest new ways of 'doing history' to other academics teaching history in order to enrich and encourage the discipline among an increasingly changing student cohort and in an interdisciplinary context. During

DST, members of community groups or individuals marginal to the mainstream or disadvantaged, are invited to participate in the creation of their own stories about their lives, which involves telling, workshopping, scripting and then making stories using digital tools and software such as Photostory (Coleborne and Bliss, 2011).

Şimşek at all.(2018) argues that in the context of education sciences most uses of DHA aims at digital skills development in Turkey which can be derived from focusing on digital component rather than storytelling aspect. On the other hand, this approach creates very limited framework for establishing awareness about social issues and avoiding discrimination when particularly working with disadvantaged groups. On the other hand they highlight there are many examples of workshop-based DST which are implemented with disadvantaged groups and focus on social issues (Christiansen, 2010; DiFulvio, Gubrium, Fiddian-Green, Lowe & Del ToroMejias, 2016; Jenkins, 2015; Jenkins & Lonsdale, 2007; Mouchtari, Meimaris, Gouscos & Sfyroera, 2015; Njeru, Patten, Hanza, Brockman, Ridgeway, Weis & Hared, 2015; Rosas at all., 2016; Stacey & Hardy, 2011; Stenhouse, Tait, Hardy & Sumner, 2013; Şimşek & Erdener 2012; Şimşek, 2012; Şimşek, 2014; Şimşek, 2015; Thas, 2015; Van Galen, 2017; Wijnen & Wildschut, 2015; Willis, Frewin, Miller, Dziwa, Mavhu & Cowan, 2014) The approach of Communication Sciences at Hacettepe University, provides the basis for exchange of experiences of disadvantaged groups and ordinary people.

Another educational theory is situated learning which has strong emphasis on social process that assumes knowledge is co-constructed and situated in a specific context and embedded within a particular social and physical environment. As Lundby (2008) noted DST is deeply rooted in collaborative process of story circle of the production workshops rather than an individual exercise- telling "my" story. Through workshop based DST Learners, negotiate how their stories should be constructed and interpreted in a story circle. For example a case given by Burgess at all (2006,) explains possibilities for individuals to construct a personal sense of place, identity and history through a DST as an inner-city redevelopment project of the Queensland Department of Housing and Queensland University of Technology.

It is also possible to discuss DST through the lenses of critical pedagogy which has emphasis on developing consciousness of freedom, that recognize authoritarian tendencies, and connect knowledge to power and the ability to take constructive action. Coleborne and Bliss(2011) find out that students commented it as 'rewarding when reflecting on the processes of the story circle because "it showed me the importance of listening to what people have to say and that every student in the circle had equally unique ideas".

It is also possible to disscuss DST as part of emerging learning theories such as connectivism, networked learning, and communities of Practice which have a large role to play in digital era.

According to these theories it is assumed that learning is no longer internal, individual but rather constructed across an information network or happen between multiple

individuals. Therefore access to different information streams or hubs are privileged for learning. Also in our concept in Turkey workshop based DST is a co-creative collaborate process where individuals not only share their experience/learning but also listen others experiences.

Education for educators

Turkey aims to raise generations equipped with the 21st-century skills, namely complex problem solving, critical thinking, innovative production, effective communication, respect for cultural differences, high level cooperation, and international competitiveness, while protecting their national identity and consciousness. Therefore, teacher competencies has been renewed based on the reflections of national and international developments on the field of education in 2017. Ministry of Education has been aimed to ensure that students are educated to be well-equipped for the needs of the time, to help improve the status of the teaching profession, and to monitor the competencies closely and allow that their results are assessed effectively (MoNE,2012).

According to policy of Ministry of Education, teaching is regarded as a profession that requires advanced competencies to carry the responsibility of human life entirely which requires teachers to be open to continuous development (MoNE,2012). In the framework of General Competencies for Teaching Profession one of the indicator is defined as making use ICT effectively in the teaching and learning process.as part of competencies for managing the teaching and learning process effectively (MoNE,2012). Ministry of Education offers portal called Educational Informatics Network (http://www.eba.gov.tr/) for supporting teachers professional development. Teachers can have access to various multimedia technologies and applications related to their courses and professional responsibilities. On the other hand, studies point out that candidate teachers don't have expected level of technology competencies (Akgün, Akgün & Şimşek, 2014; Yılmaz & Ayaydın, 2015).

Challenges and the use of technological innovation

Currently there is not any implementation of blockchain in Turkey. However there are newly created labs which recognise potential of blockchain technology and aim at making research about it. The success of the blockchain ecosystem requires being able to deliver its promise of decentralization which is a question of efficient protocol development and answering usability needs for better inclusion.

Ministry of education has emphasis on learning analytics and keeping record of every students', schools detailed credentials in order to make education adaptable to different needs of students and schools in Turkey. Therefore in our context managing credentials and hosting multimedia objects in distributed web and awarding active participation of

learners to produce their own media throughout blockchain can be considered as great potential. Lubin, J. at all. (2018) discuss blockchain-enabled solution could give local social networks greater agency and incentive feedback loops, thereby empowering marginalized communities to develop their own tools for change.

In terms of challenges of workshop based co- creative collaborative DSTs, Şimşek at all.(2018) discuss different ways of DST usage in educational contexts and they found out main challenges in relation to the multi-media focus, as time consuming process, technical problems, demotivation of students, lack of resources when using DST in educational context.

Business aspect of ICT in education and inclusion in Turkey

According to the Ministry of national education statistics total education budget is 120.827.565.000TL (around 19,957,264,364 USD) in Turkey in 2018. MoNE's Budget Appropriation is 92 528 652 000 TL, Budgets of HEC + Universities is 27 761 363 000 and SSPC(Student Selection Placement Center)'s budget is 537 550 000 TL (88,587,901 USD).

Allocation of the budget of Ministry of National Education MoNE (2017) for year 2018 by economic classification and it's ratio to net budget appropriation of year 2017 is given below:

Ödenek türü Type of Appropriation	2017 Yılı Bütçesi Budget of year 2017 (TL)	2018 Yılı Bütçesi Budget of year 2018 (TL)	2018 Yılının 2017 Yılına göre Artış oranı Increase ratio of 2018 as compared with 2017 (%)
Toplam - Total	**85 048 584 000**	**92 528 652 000**	**8,80**
01 **Personel giderleri** Personnel expenditures	58 552 662 000	63 503 243 000	**8,45**
02 **Sos.Güv.Kur.Dev.Pir.giderleri** Insurance premium expenditures	8 926 306 000	9 785 948 000	**9,63**
03 **Mal ve Hiz.Alım giderleri** Goods and Services Purchasing Expenditures	8 106 505 000	8 693 097 000	**7,24**
05 **Cari transferler** Current transferals	2 202 960 000	2 784 739 000	**26,41**
06 **Sermaye Giderleri** Capital Expenditures	7 237 121 000	7 737 121 000	**6,91**
07 **Sermaye transferleri** Capital transferals	23 030 000	24 504 000	**6,40**

According to Public Information and Communication Technologies Guide by Republic of Turkey Ministry of Development 5.067.000.000TL (835,071,968 USD) budget has been allocated for 255 projects from the central budget in 2018. 1.000.000.000TL (164,819,317 USD) is allocated for the biggest project of MoNE that is called FATIH in 2018 (Kalkınma Bakanlığı, 2018). In addition, according to a report of Turkey Informatics Industry Association, market size of ICT is approximately 11.900.000.000TL (1,961,349,875USD) in Turkey. The components of the sector are distributed 1.3 billion TL (214,156,811 USD) for Hardware, 2.6 Billion TL (428,313,622 USD) for Software,

Services 1.4 Billion TL(230,731,424 USD) , 3.5Billion TL (576,828,560 USD for Equipment, 5.7 Billion TL (939,676,850 USD) is for Electronic communication.

National recommendation to SELI project

Considering SELI project is not only about ICT development but also it has strong emphasis on contribution to social issues particularly faced by disadvantaged groups we definitely need to focus on country level needs and concepts. In Turkey, we particularly focus on physical education teachers' education to improve active and healthy lifestyles of students. On the other hand, this is not something that can be limited and achieved only within a school environment but in a broader concept which sustains during the course of people's life. Therefore our expectation from SELI extends out of school, remains throughout after school programs and involves shareholders such as NGO's promoting individuals' active quality lifestyles. Collaboration among shareholders is essential to have real impact. We seek SELI as an empowerment tool rather than narrow ICT integration in classrooms. Therefore, in Turkey we prefer to use platform under an umbrella term called "Active Quality Living Research Guidance" which works as an online community of practice to promote public health. *Communities of practice* are groups of people who share concerns or a passion for something they do and learn how to do it better as they interact regularly (Wenger, 2006)

Wenger (2006) identify three characteristics of communities of practices

The domain, defined by a shared domain of interest.

The community, members engage in joint activities and discussions, help each other, and share information.

The practice, members develop a shared repertoire of resources: experiences, stories, tools, ways of addressing of recurring problems-in short a shared practice.

Considering emerging learning theories such as Connectivism, Networked Learning, and Communities of Practice which have a large role to play in digital era, we should consider principals of these theories when designing platform. We suggest that platform should allow hosting and distribution of co-creative collaborative storytelling projects of learners (teachers and students) who has focus on researching and improving active quality way of living. It is also important to record credentials of students for assessment, evaluation purposes. Providing incentives for active participation of students and teachers in the learning platform can be a great innovation provided by blockchain integrated project.

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DIGITAL INCLUSION, ICT IN EDUCATION IN URUGUAY

Abstract: This paper reviews the state of the art of the digital divide in Uruguay. It refers to public policies to solve the digital divide and to ICT in Uruguayan education and digital literacy in the case of Uruguayan teachers and preservice teachers. It concludes that within the context of progressive government policies, since 2005 there has been a display of a variety of effective policies aiming at digital inclusion. As for education, although there has been a massive distribution of portable computers in educational centers, there is no evidence that this process has been translated into a generalized integration of technology to educational practices, meaning a significant change in learning outcomes. The paper also refers to ICT for the disadvantaged people and Universal Instructional Design: the way it has been considered and the current stage in the development in inclusive policies. It concludes that actions have been taken, mostly aiming at social awareness processes and the legislation of rights of the disadvantaged people; however, this process has not yet reached the stage when specific measures are taken to compulsory adapting digital technologies to principles of accessibility and universal design.

Keywords: digital divide, digital literacy, inclusive education

Digital divide in Uruguay and public policies to solve the digital divide

According to Eurostat, European Statistical Office[15], the notion of digital divide refers to the distinction between those who have access to the Internet and can make use of quality services through the World Wide Web, and those who are excluded from that possibility. The term also refers to the differences among the groups in terms of their competencies to use Information and Communication Technologies (ICT) efficiently, as far as their levels of digital literacy, access problems, and different shortcomings are concerned. Occasionally it is used to single out the differences between the groups which have access to quality content, and those who do not.

A way to measure the digital divide is by considering two dimensions: (1) access to ICT and (2) how these technologies are used.

Public policies aiming at bridging the digital divide in Uruguay, must be contextualized within the display of policies with emphasis on equality, social inclusion and educational inclusion. They have been carried out by progressive governments since 2005 on, throughout three consecutive government periods, up until today. The following data on policies and programs are highlighted as particularly relevant in this area.

The most recent information about access to ICT in Uruguay dates back to 2017 and it was published by the Social Observatory of the Ministry of Social Development[16]. According to this data, 66.2% of the population have access to the Internet in their homes, 26.3% of the population at poverty levels and 69.6 of those above poverty levels, have access to the Internet at home. Even though those numbers are not optimal, they show a significant increase as compared to the year 2006, when the percentages were 1.6% at poverty level and 20.5% for those above poverty level (same source).

According to data from the same observatory, in the year 2017, 81.9% of the population have a cellular phone. So do 62.7% of the people at poverty levels and 83,4% above poverty levels.

In the year 2017, 76.6% of the population had a computer at home, compared to 27,1% in the year 2006. As for the people at poverty levels, 68.7% had a computer at home in the year 2017, compared to 7.7% in 2006. The percentages for people above poverty levels were 77.3% and 36.4 in the years 2017 and 2006, respectively.

As for the use of ICT, according to Eshet-Alkalai (2004), measuring ICT use should correspond to measuring digital literacy**,** that is to say the basic digital competencies required to adequately develop other skills. At the moment of producing this report, no publications have been found about the measurement of digital literacy in the Uruguayan population in general terms. However, some basic data have been published by

[15] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Main_Page

[16] http://observatoriosocial.mides.gub.uy/portal/indicadores.php

the Social Observatory of the Ministry of Social Development[17], which correspond to the year 2013.

The following percentages show how people who are 14 years old or above, use the Internet for personal and job-related uses, (measured in urban areas): (1) personal use, to communicate: 99,5%, (2) job related: 43%. At poverty levels, percentages are 99,5% for personal/communication and 41,2% for job-related uses. Above poverty levels, porcentajes are 51,5% of job related uses and 99,4% personal use.

Some of the causes of the existence of the digital divide in Uruguay have been outlined by Zunini Martinez (2016) and also by Rivoir and Escuder (2018). Zunini Martinez (2016) states that one of the causes is the difference in Internet coverage in urban versus rural areas. However, the author states that the phenomenal increase in the number of mobile phones opens an array of possibilities to expand Internet connection in homes. She also points out that in small towns and rural areas the shortening of gender divide contributes to the reduction of the „territorial digital divide" in the use of ICT.

Rivoir and Escuder (2018) apply a multivariate analysis to data from the survey on uses of information and communication technologies (Encuesta de Usos de Tecnologías de la Información y la Comunicación, EUTIC 2013) carried out by the National Institute of Statistics of Uruguay. They intend to establish the group of variables that determine relevant factors in the digital divide. They conclude that there is a persistent close connection with income inequalities and access gap in homes. According to this study, the group that is the most highly affected by the digital divide is that of the socioeconomically disadvantaged people.

Also, physically or intellectually disadvantaged people, as well as immigrants, are among the most affected social groups, due to their low income and their problems in accessing the labor market. The elderly, who live on pensions or retirement plans, are also affected by low income, adding up to the fact that they belong to a generation that has not closely accompanied technological changes. These two conditions make older adults one of the hardest groups to achieve digital literacy.

Public policies to resolve the digital divide in Uruguay

The **Digital Uruguay Agenda** (Agenda Uruguay Digital[18]) provides examples of public policies aimed at bridging the digital divide. It was established in 2007 and it is systematically reviewed. The following examples should be highlighted:

- **Plan Ceibal**[19] and its impact on accessibility to the Internet and to computers, particularly in the case of socioeconomically vulnerable population. **Plan Ceibal**

[17] http://observatoriosocial.mides.gub.uy/portal/indicadores.php

[18] https://www.agesic.gub.uy/innovaportal/v/125/1/agesic/Brecha-Digital.html)

[19] https://www.ceibal.edu.uy/en/institucional

is a connectivity plan, implemented in 2007 following the „one laptop per child" model with the objective of introducing ICT in public education at primary and secondary public schools. The project was named „Ceibal" after the name of the typical uruguayan tree and its flower called „ceibo", known in English as Cockspur coral tree. As an acronym, CEIBAL stands for „Conectividad Educativa de Informática Básica para el Aprendizaje en Línea", Educational Connectivity/Basic Computing for Online Learning. Its scope is national, allowing children in public education centers to receive a portable computer with wireless Internet connection (WO-FI), both in and outside the classroom.

- **Universal Internet Household Service** (Plan Universal Hogares), is a program whose objective is to promote „Internet for all", providing free Internet connection to all homes that have fixed telephone network connection. It involves the deployment of optical fiber to all households and schools. Antel, the Uruguayan state-run operator, offers a fixed-broadband access basic plan which comprises up to 1GB of data per month, at a speed of 512 kbit/s, without additional cost for fixed telephone network connection. The International Telecommunications Union (ITU) published the 2018 edition of the Measuring the Information Society Report, which analyzes the prices of broadband-access service basket prices, in reference to the country's average monthly.

  According to this report[20], Uruguay leads the ranking in affordability, worldwide. It is the only country in the world, that offers an Internet access service for digital inclusion of the population, cost-free for households.

  As for the prices of mobile broadband, handset based (500MB) and computer-based (1GB), Uruguay ranks in the 12th and 28th position, respectively, leading the regional ranking with the most affordable service costs among the countries of the Americas (USA and Canada included).

- **Plan Ibirapitá**[21] has been conceived as a solution to the digital divide among low income, retired elders. It provides them with tablets connected to the Internet and training on how to use these devices. It also offers workshops and support necessary to ensure successful a user experience. Plan Ibirapitá was created by means of Decree 130/15, by the executive branch of Uruguay in 2015.

  Bruno Guedes (2017) studies elder digital immigrants and their use of social networks, particularly Facebook. His study confirms the importance of these devices to promote social interaction with friends and family, thus developing social bonding and shortening geographical and generational gaps. So far, there are no published other independent systematic evaluations of Plan Ibirapitá.

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[20] https://www.agesic.gub.uy/innovaportal/file/7534/1/misr_2018_vol_1_e.pdf

[21] https://ibirapita.org.uy/

ICT in Uruguayan education and digital literacy in Uruguayan teachers.

There are no recent publications which systematically measure the use of ICT by teachers in their classes.

Plan Ceibal has fostered the use of the Adaptive Platform for Mathematics offered by Bettermarks (PAM, which stands for Plataforma Adaptativa de Matemáticas) among teachers in secondary levels. It has done so by delivering workshops for teachers and by promoting contests among students who use the platform intensively. However, there is no evidence of improvement in the level achieved in Mathematics by students. Neither is there evidence of an improvement in language use, after the massive implementation of CREA platform (Learning Management System) offered by Shoology for secondary education.

The report entitled „Deepening into effects of Plan Ceibal" (De Melo, Machado, Miranda and Viera, 2013), published by the Institute of Economy of the University of the Republic and financed by Plan Ceibal itself and the National Administration of Public Education (ANEP) states that the distribution of portable computers has not generated an improvement in the academic results of students. The report also states that developing strategies that aim at fostering teacher empowerment and developing competencies which allow teachers to focus on teaching and learning with ICT, is of paramount importance.

The work by Caballero de Luis (2017) comprises a systematic review of the academic research published in the data basis of Web of Science, Scopus and ERIC, about the incidence of Plan Ceibal on teaching and learning in Uruguay, throughout its implementation in the period 2001 to 2017. The research reviewed reveals that the majority of primary and secondary students do not use their laptops in the classroom and that the teachers have not modified their teaching practices. It also reports on the need for students to discriminate and discern within the information load that they access in the Internet. The study also confirms the contribution of Plan Ceibal to bridging the digital divide by introducing laptops: 11% of households have access to a computer thanks to Plan Ceibal. This study also points out, that Téliz (2015) showed how Mathematics teachers in the department of Artigas, had very limited use of this resource in their teaching, and there was a group of teachers that did not use them at all. Among the main findings of this study, there is the evidence of a contradiction between what teachers think -their opinions and beliefs— and what they do -their practices— They have a positive perception of the use of ICT in teaching practices and they identify many aspects associated to different dimensions of teaching that are considered good teaching of Math. However, they would generally not integrate these tools to their own teaching didactic approaches.

Ceretta and Canzani (2016) review different documents related to evaluations of Plan Ceibal, including official documents. They conclude that there are only a few contexts where there has been a positive impact on the learning process. They single out

some experiences in the teaching of Mathematics and English, but they state that no positive results have been reached in language use or information assessment.

As for foreign language teaching, a program called „Ceibal en Inglés" has been created and implemented at primary level, for the purpose of English teaching (https://ingles.ceibal.edu.uy/que-es-ceibal-en-ingles). Students take weekly classes with a distant English teacher through a video conferencing system installed in their study center. Both distant English teacher and grade teachers collaborate using the CREA platform (Learning Management System used by Schoology). They share lessons and resources throughout the development of the class. Remote teachers work with uruguayan students not only from Uruguay but also from countries such as Argentina, Great Britain, the United States or the Philippines.

In the University of the Republic, the Moodle platform is widely used, mainly as a repository of resources. Also, forums and the Moodle tool „task" is used as a means of delivering work done by students, but there are only a few courses which design interactive or collaborative tasks or promote student production and publishing. The use of video conferencing has increased for filmed classes or for tutoring students who cannot attend, due to distance or scheduling problems. A tendency that has gradually been seen is the use of e-portfolios, social networks and open educational resources. Examples that describe these activities can be read in the work of Barreiro et al. (2018), Rodés & Díaz (2018), Czerwonogora, A. (2017a), Czerwonogora, A. (2017b), Rodés et al. (2013).

Digital literacy in Uruguayan teachers

The study of Chetty *et al.* (2018) identifies the necessity of a multidisciplinary framework to assess digital literacy. Within the context of their study, digital literacy is formed by five disciplines: information literacy, computer literacy, media literacy, communication literacy and technology literacy. Each discipline is further influenced in terms of three perspectives: cognitive, technical and ethical in the manner the learner should use a particular tool.

Considering all these disciplines and their three dimensions, there are no systematic studies that evaluate digital literacy on Uruguayan teachers. A first work is that from Morales et al. (2017) that applied a questionnaire to students of teacher training. The referred study, which compares students in teacher training in both Uruguay and Chile, reveals that the average values in student-teachers performance displaying digital competency is barely above 50%.

ICT for disadvantaged people & Universal Instructional Design

Based on the current inclusion and other social issues, there are two populations to be appointed as particularly relevant in Uruguay. On the one hand, there is the topic of

access to education for the physically or intellectually disadvantaged, and on the other hand there is the problem of inclusion of the increasing immigrant population that the country has been receiving in the last decade.

ICT for physically or intellectually disadvantaged people

Public policies aiming at the inclusion of physically or intellectually disadvantaged people have been carried out in Uruguay by the National Program for the Disadvantaged (Programa Nacional de Discapacidad, PRONADIS), of the Ministry of Social Development (Ministerio de Desarrollo Social, MIDES) and it coordinates with a variety of social agents, the most relevant of which are the National Administration of Public Education (Administración Nacional de Educación Pública, ANEP) and the biggest university of the country: University of the Republic (Universidad de la República, UDELAR).

Two major advances in inclusion policies are described below: (a) National Plan of Access to Justice and Legal Protection of Persons with Disabilities, (b) Performance protocol for the inclusion of disadvantaged people.

(a) The National Plan of Access to Justice and Legal Protection of Persons with Disabilities was approved by presidential resolution 893/015, on 09/14/2015. It is based upon a concept of justice as a doorway to all other rights. This plan has a beginning in the need to develop strategic actions that show applicability and efficacy in the promotion and the effectiveness of Human Rights, based on incorporating internationally updated parameters in this matter. Also, it intends to accompany the most recent changes in the field of disabilities.

The plan has a direct impact on inclusive education, in its strategic line number 3: *Promotion of degree program education, postgraduate university education and tertiary education in terms of disabilities and access to justice, in public and private sectors. It promotes transversalization of disability issues in degree programs, postgraduate, research, extension in tertiary and university education.*

We highlight the fact that there is still a long way to go in terms of transversalization of disability issues and on familiarizing with a social disability model in academic contexts. In the Education and Teacher Training Council of Uruguay (Consejo de Formación en Educación), it is not until the end of 2018 that a commission[22] is appointed to start the implementation of the performance protocol for the inclusion of disadvantaged people. Moreover, the topic of disabilities and inclusion is not considered in the curriculum in the school or middle and high school teacher training program. It is only addressed in professional development in service courses. It is vital that teachers be

[22] Resolución del Consejo de Formación en Educación: http://www.cfe.edu.uy/images/stories/pdfs/resoluciones_institucionales/interes_gral/2019/acta47_res60.pdf

educated so that there is a possible transition from a special education framework to an inclusive framework.

Finally, we should point out a few institutions and organizations committed to teacher education and accessible resources design and digital platform design.

- The Center for Blind and visually impaired students. (CeR)[23] The Secondary Education Council provides personalized support to blind and visually impaired students to finish secondary education and also provides accessible resources.
- The University of the Republic has an Interdisciplinary Group of Open and Accessible Resources (Núcleo Interdisciplinario de Recursos Educativos Abiertos y Accesibles)[24]. This group has implemented some practical steps, such as the creation of an accessible Moodle for the University of the Republic, used by PRONADIS to teach its courses, the creation of an Accessible Digital Library[25], with educational resources for the first teaching levels and in a transition process to become available to university students and a series of in service courses related to accessibility and inclusion.
- Consejo de Formación en Educación, Universidad de la República y Flacso Uruguay provide a specialization courses on inclusive education open to those teachers who might be interested.[26]

(b) Performance protocol for the inclusion of disadvantaged people.

Based on the recommendation of the general comment number 4 and on article 24 of the Convention on the Rights of Persons with Disabilities, a performance protocol was designed for the inclusion of people with disabilities in educational centers, (Decree 72/017)[27]

The protocol aims at creating a frame of reference that contributes to the integration of people with disabilities to the educational centers, both public and private, dedicated to formal or informal education. It is a guide for reference and consultation regarding best practices and standards for including people with disabilities. The protocol promotes the development of spaces for participation, information, networking, orientation and consultation in the educational center. It is a tool for orienting an approach to the topic of disabilities in educational centers.

The protocol provides orientation to actions taken in educational centers and involves the following aspects (article 4 of the protocol):

A. Academic support strategies for people with disabilities -concept of Universal Design, curricular adaptation, among others- which in all cases shall be carried out

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23 Accessible in https://www.impo.com.uy/bases/decretos-originales/72-2017#ANEXO

24 See http://www.nucleorea.ei.udelar.edu.uy/

25 http://www.bibliotecaaccesible.ei.udelar.edu.uy/

26 See http://flacso.edu.uy/web/226-docentes-aprueban-curso-educacion-inclusiva/

27 available in https://www.impo.com.uy/bases/decretos/72-2017.

with the methods that have been validated by the nationally competent authority and by professional teams that are competent in supporting inclusion.

B. Indicators guide of best pedagogical and didactic practices.
C. Accessibility of environments: furniture, teaching resources, tools and work equipment, among others.
D. Sensitization, information, prevention and training to all people who work in the center.

We should highlight the contribution of the protocol in terms of conceptualizations and recommendations about accessibility at an educational level. This means making physical environments, educational devices and pedagogical resources in such a way that they minimize the barriers to learning and guarantee the participation of people with disabilities in all stages and instances of the educational proposal. Special attention should be given to the revision and suggestions based on Universal Design for Learning (UDL) which refers to the different types of accessibility: cognitive, physical, informational, communicational, and material and text related.

Also, actions taken by the National Disabilities Program (PRONADIS) from the Ministry of Social Development (MIDES) should be guided by a strategy geared towards early inclusion, which intends to make the issue of people with disabilities visible. According to his strategy there are 4 pillars to take into account for early inclusion:

Rights: this perspective recognizes and intends to guarantee the rights of all and for that it makes available resources and services visible and available, facilitating information and eliminating physical and bureaucratic barriers that prevent access.

People-centered: support, services and benefits should be timely centered in the people.

Participation: carried out by means of a variety of methods that promote empowerment and co-responsibility of participants.

Universal Design (UD): It is a paradigm that recognizes the diversity of all human beings and aims at developing services, programs and proposals that cater to inclusion of all the population. Universal Design is defined by the International Convention of the Rights of People with Disabilities as „the design of products, environments, programs and services that may be used by all the people, to the greatest extent possible, without the need for adaptations, or specialized design."

As a means to ensure the applicability of early inclusion in the context of the public policy named „Uruguay Grows with you" (Uruguay crece contigo, UCC[28]), the program PRONADIS, carried out by MIDES has been working with referents from the education system to achieve an Inclusive Primary Education. This idea develops the notion of schools and nurseries network called Mandela Network, based on the idea of „learning together", implementing the inclusive perspective in the Uruguayan Educational System. Creating „Red Mandela" is part of a transformative process in Uruguayan education. Its

[28] http://www.mides.gub.uy/41937/uruguay-crece-contigo-ucc

objective is that special schools become resource centers, redefining the role of support to inclusive education. The final aim is that all children with disabilities be included in educational centers of Primary education.

It is important to point out that, in the face of these normative and practical improvements, there are no recent studies related to ICT and disabilities. For example, there have been no findings in the following areas:

- digital platforms that include the universal design for learning perspective and early inclusion in the educational system
- legal clauses that determine as obligatory the existence of accessibility tools in tender documents for virtual platforms for public education.

Migrants: the problem of South — South migration, and its integration to the educational system

Same as many other Latin American countries, Uruguay is currently facing an increasing South -South migration process. This phenomenon has a great impact on our education system and it also promotes a population that faces new vulnerability risks. In order to understand the many dimensions of this problem, it is enough to see the evolution of the numbers of residencies provided in the last years. In 2010, Uruguay granted residence to 2,500 people, while 15,000 were granted in 2017, a figure with has kept increasing[29]. The following evolution of residencies granted to Venezuelans is also illustrative: 2014: 78 residencies, 2015: 1,100 residencies, 2016: 1,340 residencies, 2017: 3,248 residencies, 2018: 5,448 residencies.

According to a study called „Characterizing new migration waves in Uruguay"[30] (MIDES, 2017), there is an increasing tendency for the reception of immigrants of „nontraditional Latin American origins" (excluding Brazil and Argentina). These immigrants come from Bolivia, Chile, Colombia, Cuba, Dominican Republic, Ecuador, Mexico, Paraguay, Peru and Venezuela. Reasons for immigration are mainly economic and job-related.

It is important to highlight that, Uruguay has a very advanced legislation for an institutional approach of migration related topics, due to the Migration Law (law 18,250 of the year 2008), which establishes that all people have the right to migrate, and they must be ensured full access to fundamental rights, without distinction of any kind, such as race, sex, language, age, religion or political opinion. However, there is consensus on the fact that public policies on the matter lack effectiveness and there is still a long way to go.

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[29] Fuente de la información: Dirección General de Asuntos Consulares y Vinculación

[30] http://www.mides.gub.uy/innovaportal/file/75559/1/investigacion_caracterizacion2017_final_digital.pdf

Research on this topic published by MIDES (2017) highlights a series of problematic issues that refer to social integration processes of immigrants:

- intricate administrative paths to obtain documentation due to fragmented approach in reference to migration policies
- immigrants lack of information about their own rights and about the benefits and services provided by the State (health, education, support form MIDES, etc.)
- lack of incentives for adult immigrants to keep studying
- access to job market, same as informality, income inequality and in many cases, overqualification for the jobs found.
- access to decent households. In most of the cases, the first residence is a rudimentary boardinghouse.
- fair treatment in sanitary and educational services. Universal access to education in Uruguay is deeply valued by immigrants.
- discrimination and tendency to cultural endogamy. Immigrants create communities where they carry out their social bonding and activities.

An element to be considered: The Council for Initial and Public Education (Consejo de Educación Inicial y Primaria CEIP-ANEP) has considered the topic and it conceives Public Education as an integration factor form a multicultural perspective. This conception should be understood as follows:

> *The integration model based on uniformizing concept of developing, is challenged by the emergence of difference. Today, more than before, it is necessary to dispose of the notion that integration means uniformity. Contemporary societies are confronted with the construction of social forms of social integration that build on the recognition of difference. Globalization tendencies imply cultivating diversity, singularity and particularity. A planetary construction is not possible without consolidating local and regional identities. (J. Arocena, cited by CEIP, 2018)*[31]

CEIP has recently appointed a Migration Commission to study the topic and it has elaborated the document „Human mobility, migrants and primary education" (CEIP, 2018). In this document, some specific challenges related to this population have been outlined. Some examples are:

Planning institutional projects that revolve around the key topic of diversity, integration and design of interventions strongly associated to living together and participation issues.

- the need to adapt the school grade and curricular contents
- the need for attention and personalized pedagogical support for immigrant children
- the need to count on technologies to support good oral and written communication with mother tongues other than Spanish.

[31] http://www.ceip.edu.uy/documentos/2018/varios/2188/Movilidad_Humana_Migracion.pdf

On the bases of these reflections, it is important to highlight that support from digital technologies and inclusive platforms could result in particularly useful aids to work with these migrant populations, as long as:

- systems incorporate different translation tools that act as a support to students whose mother tongue is not Spanish, while students acquire speaking and writing skills in Spanish as a second language.
- allow for personalized follow up and the development of personalized tasks to level students whose educational paths have been different from that of most of the class
- national educational programs take into account the special situation of adult migrants (especially women) offering them distance courses, allowing permanent ubiquitous education models.

Business aspects of ICT in education

Cuti[32] is the association of Information Technology and Communication companies in Uruguay. It is a non-profit, private entity, founded in 1989.

Currently composed of more than 350 companies that offer products and services to more than 52 markets, its mission is to promote the development and growth of Uruguay's technology industry.

However, it is observed that a search among its partners for the industry area „ education" returns only 19 companies. If we add to the search „education and blockchain" or "education and analytics" there are no company registers. For the search „education" and „training & e-Learning" four companies are obtained.

Conclusions

In reference to public policies aiming at bridging the digital divide, the data presented by the Social Observatory of the Ministry of Social Development, provide evidence of a clear improvement in the digital divide, in the last ten years. It must be highlighted that this improvement can be observed in the dimension of the "access to ICT", understood as having a device and an Internet connection, as a result of a variety of effective policies, especially in the case of vulnerable populations, such as the socioeconomically most deprived or the elderly (Plan Ceibal, Plan Universal Hogares and Plan Ibirapitá). Even in the practical dimensions of digital citizenship, important improvements can be observed. Some examples of this, are the courses made available by the Agencia de Gobierno Electrónico y Sociedad de la Información y del Conocimiento (AGESIC), in English: Electronic Government and Information and Communication Society Agency), using

[32] Cámara uruguaya de tecnologías de la información https://www.cuti.org.uy

the learning platform of Educantel[33] about topics such as personal data safety, access to public information, information safety, State formal procedures catalog, etc. Another example is the availability of resources about education in digital citizenship, Retrieved from the website named Digital Citizenship Library,[34] of AGESIC. Another one is the case of the Jornadas de ciudadanía digital un abordaje sobre brechas y oportunidades para la inclusión digital[35] (Digital Citizenship Work Day: An Approach about Divides and Opportunities for Digital Inclusion).

Contrary to what has been expressed above, the same improvement cannot be found in the dimension of "use" of digital technologies, directed related to digital literacy (Bawden, 2008) or use and the solution of accessibility problems. The notion of digital literacy does not mean merely having a device and an Internet connection. Rather, it means a more complex understanding of digital inclusion, considering the real benefits that the user is able to obtain from the use of technology and from the Internet (Helsper, 2019). Digital literacy requires considering educational aspects, related to the development of digital competencies: informational, technological, cognitive and the so-called multiple literacies (Area & Pessoa, 2012). These literacies allow the exercise of digital citizenship, both in pragmatic aspects and in informed citizen participation.

As for the use of ICT integration in education and digital literacy of preservice teachers, although efforts have been made to reach a massive distribution of portable computers in educational centers, there is no evidence that this digital inclusion, in Uruguay, has been translated into generalized process of integration of technology to educational practices, meaning a significant change in learning outcomes. However, consistent with an image of uneven appropriation and development processes of digital technologies, some specific worth mentioning experiences can be highlighted, considering its achievements for both teachers and students.

Among those experiences referred above, we can point out English teaching and Math teaching. Both of them reveal the existence of groups of teachers who have had the experience of exploring inclusion ICT tools (Marconi, C., Goyeneche, J. J., & Cobo, C. ,2017). The work in robotics, led by Pan Ceibal deserves another special reference. Two recent facts should be mentioned as a sample: the Robotics, Videogames and the reward received by Uruguay students at the Programming Olympics that nucleated 1800 students and 450 teachers from all over the country on the 24th and 25th of October

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[33] Educantel is a product of the ANTEL system, that designs and implements open access formative actions for the population, among other functions. Available at https://educanet.antel.com.uy

[34] This library can be accessed here: http://ciudadanodigital.gub.uy/

[35] Information about this event can be accessed in the presidency website here: https://www.gub.uy/agencia-gobierno-electronico-sociedad-informacion-conocimiento/comunicacion/noticias/comenzo-jornada-ciudadania-digital-vale-distraerse

of 2019, and the award obtained by students in the Open International de la First Lego League de Fairmont, Virginia, USA, organized by NASA.[36]

Nevertheless, it is important that we clarify that up to date, Uruguayan teachers do not count on a teacher education and training program that includes a systematic approach of the ways in which ICT should be integrated into innovative pedagogical and didactic teaching practices. Also, programs and curricula implemented, do not consider systematic accountability assessment of the uses of ICT on the part of the teachers in their classroom practices.

So far, it can be stated that teachers in Uruguay are at a variety of different levels of digital technology appropriation and integration, in a model that follows a pattern of innovation niches, developed around the initiatives of enthusiasts (Himanen P., 2015), more than as a result of an orderly, generalized action plan of integration of ICT to teaching practices. On the other hand, in preservice teaching programs, teacher education and development in the integration of digital technologies does not have a unified perspective as far as preservice centers and institutions are concerned. (Cabrera C. Cabrera A., Carámbula, S., Pérez, A., & Pérez, M., 2018; Puglia, E., 2016; Porta & Puglia, 2019)

In the area of ICT for the disadvantaged people and Universal Design, social awareness processes and institutional actions towards the legislation of rights of the disabled people, have been taking place. Among those actions, there is the politician decision of fostering inclusive education, implemented by the program Uruguay crece contigo (UCC), in English Uruguay Grows with you. The strategy of "special schools" is gradually abandoned, establishing the goal that, in the long run, all disadvantaged students be included in the regular elementary schools. However, this process has not yet reached the stage when specific measures are taken to compulsory adapting CT to principles of accessibility and universal design.

Finally, there is no clear synergy between the innovation in education and inclusion and the private companies dedicated to software development in Uruguay.

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[36] For more details about this news, see here: https://www.presidencia.gub.uy/comunicacion/comunicacionnoticias/alumnos-atlantida-ganan-premio-eeuu-robot-compania-plan-ceibal-first-lego-open-nasa at Uruguayan presidency website.

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