

REVIEW ARTICLE

Introduction of digital technologies in education - Concepts and experiences

Wolfram Laaser¹, Cecilia Exeni²

¹ ex Fernuniversität, Hagen, Germany;

² National University, Cordoba, Argentina.

Corresponding author: Dr. Wolfram Laaser;
Address: Milly-Steger-Str. 1, D-58093 Hagen, Germany;
E-mail: wolframlaaaser@gmail.com

Abstract

During the last decades technologies of information and communication technologies made a lot of progress, which increased the quantity and quality of distance education programs and the upcoming blended learning models. However, some basic difficulties in defining meaningful terms instead of buzzwords, often used in the present debate, will be discussed to raise consciousness of the rather vague terminology. The progress of digital technologies offered also a chance for better inclusion of disadvantaged parts of the population. The focus lies on the young generation of school attendants and how technology-oriented programs can provide better inclusion. We put a regional focus on development in Latin America. To highlight some of the issues discussed before, we will present a detailed case study about the Argentinean project “ConectarIgualdad”. We have also added a brief comparison with some other Latin American Initiatives. Summarizing we list considerations for a successful inclusive application of digital technologies in education.

Keywords: Argentina, ConectarIgualdad, digital, digitalization, digital technology, inclusion, netbooks, one laptop per child.

Conflicts of interest: None.

Introduction

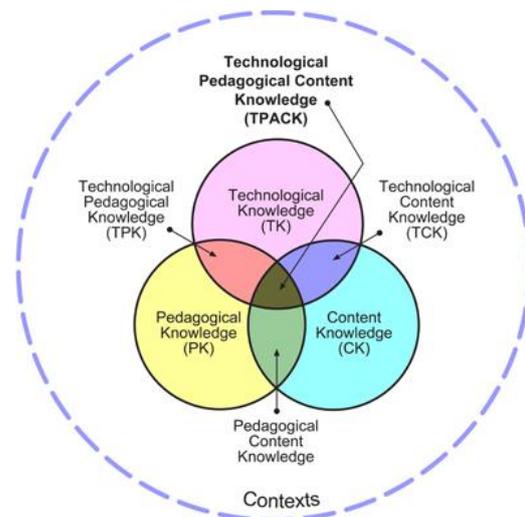
During the last decades, information and communication technologies advanced at a fast rate and impacted on education, especially on distance education, both, in a qualitative and in a quantitative way. The range of options of how to introduce and apply the new technologies in online distance education were manifold. The recently upcoming format, called MOOCs (Massive Open Online Courses) is an example. MOOCs give open access to knowledge of well-known universities at zero or at least low cost, without asking for any necessary certificate about prior qualification. MOOCs range from free of charge short online courses with massive enrolment up to offers of complete online Master degree course. Some MOOCs are directed to an open non-expert general public, e.g. a MOOC for integration of refugees, others are directed to the higher education segment. The structure then will be more curriculum bound. Many MOOCs form part of continuous adult education or are applied in enterprises for “training on the job”.

MOOCs attracted students from all over the globe. The first MOOCs started in Canada with a constructivist student-centred approach. Later some well-known US American Universities took over and changed MOOCs to a behaviouristic model. The open courses demonstrated their impact on distance learning by use of online pre-recorded video lectures instead of printed study units and multiple-choice tests instead of written or oral exams. However, the video presentation format was simple and the assessment and evaluation not very profound (1). Today, MOOCs are offered by many national universities from all over the world. However, they represent only a small part compared to the total number of traditional courses.

In this context we could observe nevertheless some changes of educational practices, though, even today we still find educational practices which emulate traditional classroom teaching approaches while applying new web-based technologies. However, more relevant is the stepwise upsurge of a pedagogy with TICs.

New affordances for teachers and students are required. A prominent example is the TEPAC (Technological Pedagogical Content Knowledge) model which describes the necessary qualifications, teachers must acquire to make meaningful use of the new technological devices. The concept has been developed during the years 2006 to 2009 at Michigan State University (2).

Figure 1. TPAK model (Source: Google images)



With respect to students’ affordances Bates postulates: “In order to develop the skills students need in the 21st century, we need to focus more on skills development than on the transmission of content. Online learning can focus better on the development of soft skills, such as communication and knowledge management. *Everything on the Internet is a potential study material*” (3). A detailed example of the expected advances to be

achieved with the use of computers in schools is the expectation that the 11-12 years old kids should acquire the following abilities:

- Creativity and innovation
- Communication and collaboration
- Search and information management
- Critical thinking
- Problem solving
- Decision taking and being a digital citizen

At the same time, technological tools have been developing according to the needs of these educational processes and the advancement of digital technologies. Likewise, we have a variety of virtual platforms, educational portals, repositories, libraries with e-books, virtual labs, etc. Accordingly, there has been a paradigmatic shift in the design and delivery of educational materials. At present, distance learning uses multimedia and interactive technologies, for example: Animated graphs, simulators, educational video games, streamed podcasts and vodcasts, etc.

Deficiencies in the definition of some related concepts

With the changes towards a digital environment, new concepts emerged with labels such as “digitization”, “Digital School”, “University of the Future”, “Education for the digital century”, “intelligent learning” or “algorithmic learning”, to describe the introduction and/or application of technologies in education. The denomination of these terms is often sketchy but not very succinct. The word “digital”, for example, refers in mathematics to the representation of analogous information by a combination of the digits 1 and 0. Digitization then is the process of transforming analogous information into its digital form. What then is a “Digital School or University?”

Basically, the digitization in the educational field is seen as a process of transformation towards implementation of digital technologies in teaching and learning. But this transformation is more complex and not exclusively a technical problem. Consequently, Segura, Quinteros & Mon (4) confirm that the “digital University” is a social and material reality and is the product of the complex relationships that are established. Digital is an adjective that no longer describes almost anything in the current university.

Many of the concepts used today refer to technologies as drivers of teaching and learning processes. People share beliefs that using the latest new technology is the most important way to modernize education and will solve most educational problems, ignoring the necessity of teachers who can work with digital tools and/or develop lesson plans or school projects. This perception is backed by companies who market the digital equipment and the respective software and thereby push the sale of their products. Audrey Watters calls it the “Silicon Valley” ideology: “Educational technology is, after all, a series of practices itself-it is not just the hardware or software. Ed tech carries with it ideologies and ideas” (5) and in another blog post she wrote: “The tech sector does love stories-grand narratives and make-believes and mythologies about revolution and disruption and innovation” (6). However, the way people accept, use and handle learning technologies is crucial in determining the success or failure of the introduction of new technologies. That is why we think, it is important to highlight how digital technologies can or should be implemented in the public educational sector.

New generation features

Information and communication technologies were created mainly for the private consumer market or business and not for educational use. However, they were very quickly adopted by the new generations who gave the mother uses: Fun, games, socialization, informal learning, etc.

In 2001 Marc Prensky (7) revolutionized the perspective on the relationship between the different generations and ICT with the concepts “digital natives” and “digital immigrants”. A series of studies and research focus on the numerous and complex facets that link children and young people with ICT education, such as: changes in social dynamics, the relocation of content, the new meaning of the learning process and schools, the connotation of technologies.

For this reason, the works of Emilia Ferreiro (8) [“Nuevatecnologías y escritura” -New technologies and writing-], together with Dussel [“Aprender y enseñaren la cultura digital”- Learning and teaching in digital culture-], Morduchowicz [“Los adolescentes y las redessociales” -Adolescents and social networks-] Martin Barbero [“Estallido de losrelatos y pluralización de las lecturas” - Outbreak of the stories and pluralization of the readings-], Virdo (los “neonativosdigitales” -The digital “neonatives”-]and Sibia [“La intimidadcomoespectáculo” -The intimacy as spectacle-], among others, tackle the conflicts and frictions that today marks the education of children and young people. Today we know that ICT increases the flow of personal interactions constantly, creates new bounds with knowledge and is used to legitimize ideological frameworks. It has a market and symbolic value that determines positions in indifferent social strata. That is why those who do not have

access to digital technologies are excluded. Silvia Bacher (9) says:

“The informational society brings a new social conception, where the disconnected (homeless children, teachers who do not feel safe in front of their students or seniors who do not access ICT) are at risk of being segregated or even more to become live witnesses of a never greater deepening of already existing exclusions. Today it is not possible to speak of a digital divide but of digital gaps framed by social gaps.”

Many students do not have access to the technologies, but it does not imply that they have a way of building knowledge determined by the logic of the screens, because that is the current reference today. Emilia Ferreiro (8) argues that those who are twenty-five years old or older did the trip from the notebooks to the screens and those who are younger are doing a reverse tour. The researcher also emphasizes the different organizations of technology and of the book industry, and analyses today’s school, in which the adults, as seldom times in history, can recognize a students’ specific knowledge and can learn from them (8).

The “ConectarIgualdad” program (connecting equality)

The context

The significant impact, that involves the use of ICT makes it part of the Educational Goals for 2021 (10) proposed by the Organization of Ibero-American States (OIS). Specifically, goal number 5 establishes the use of these in classroom practices, affirms the potential of ICT in education and states: “It is not limited to the digital literacy of the population. It is also expected that these can be introduced across the teaching-learning process, facilitating the creation of modern skills and improving the educational

achievement of the scholar”. From the adhesion to the Educational Goals for 2021, several Latin American countries implemented educational programs with ICT, based on the Negroponte model “One laptop per child”. The Argentine program is in this line one of these programs.

Objectives and implementation

In Argentina, the National Education Act no. 26206 (10) is sanctioned. This law puts the focus on social inclusion and human rights. This framework establishes the use of ICT in the classrooms. This is explained in article 100:

The National executive branch, through the Ministry of Education, Science and Technology, will set the policy and develop educational options based on the use of information and communication technologies and the mass media of social communication, collaborative with the fulfilment of the purposes and objectives of this Law (p. 20).

Accordingly, with this law, the “Conectar Igualdad” program was created with the purpose of implementing a digital inclusion policy that enhanced public school and reduced the digital, educational and social gaps in Argentina.

Figure 2. Conectar Igualdad reaches the most vulnerable sectors (Source: Google Images)



The program focused on two lines of action:

- Deliver netbooks to students and teachers of middle school, high school, college (associate degree) and special education 1 to 1 (“One Laptop per Child”);
- To train teachers in the pedagogical use of ICT and to guide them in their classroom practices while using netbooks.

Equipment

The implementation of the program began with building “technological floors” in

each school. Each one had a school server which was connected to each of the netbooks. Each netbook was delivered to teachers and students of that school. It also disposed of a school network through a switch and access points placed in each of the classrooms. Five million netbooks were delivered during five years of the program.

Two years later the “Digital Elementary” program was added. This program also provided netbooks to schools, but in the format of “mobile digital classrooms”. These included: 30

netbooks, an interactive digital whiteboard, a projector, a router, a server and a cart to transport equipment.

Training and guidance

Education with technologies has many epistemological perspectives. Considering the articulation between the specificities of each science and the inclusion of ICT, unprecedented specializations were done in the field of education, communication and educational technology to be able to address them. For the netbooks, help desks were provided with software and educational materials according to each of the recipients. Even today it is possible to find on the WEB and download the “Teacher’s desk”, the “Student’s desk”, the “student desk for ESE (exceptional students education)”, etc. In addition, many multimedia educational materials have been developed and were available in different formats and platforms. For example, television channels such as “Paka-Paka” and “Encuentro”, the first directed to early childhood and the second to audiovisual educational and cultural topics. In addition, the official educational portals, such as Connect, Educ.ar and Digital Elementary are accessible.

At the same time, “Huayra” GNU/Linux was developed, an operating system for the Argentine educational community based on Debian. This operating system had applications, suggested by teachers and was constantly renewed. The netbooks carried two operating systems “Huayra” and Windows.

The pros and cons of the “ConectarIgualdad” program

Over the course of its few years, the program has received both criticism as well as positive comments. Detractors argue that no improvement in educational quality was visible. They also emphasized the fact that students use netbooks to connect to social networks and video games. Those in favour of “ConectarIgualdad” said that the program improves learning and that the school does not consider in the classrooms. Also, it evaluates the quality of education from paradigms that do not contemplate the ways that new generations are learning.

The emphasis of the criticism was on the school, however the main objective of the program was to promote the inclusion of those more vulnerable social sectors that otherwise would not have had access to a computer with all that what it socially means. The criticism, based on the helpless, argue that “the poor need to cover basic needs: food, medicine, a home, etc.”. Now, it is precisely about the consumption of “superficial” goods where the processes of distinction and classism are established in stratified societies such as ours. Perhaps what irritates the people about the “ConectarIgualdad” program is that they are granted free goods that are expensive and could be used as signs of distinction by the dominant classes (12).

Figure 3. Drone and Robot model of the “Aprender Conectados” (Learning Connected) program (Source: Ministry of Education, Argentina)



The “ConectarIgualdad” program was disabled and in its replacement, “Aprender Conectados” (Learn Connected) was created. This new program changes the target and puts focus on competitiveness, innovation and digital inclusion. For their implementation, they take the existing equipment in the schools (that “ConectarIgualdad” left) and distribute robots and drones with different degree of complexity to kids, aged eight years or more. For about 30 students five items are at their disposal.

The delivery of these resources has not been well received by the teachers. They argue that they cannot do very much. Once students learn to program robots and drones, which they do quickly, the resource loses its educational function, unlike computers that have a lot more possibilities. In this regard, Da Porta (13) says: “The bombastic release of ‘Aprender Conectados’ put the emphasis on the promises and illusions of technology, it makes evident the rejection of an equal

social policy that even with its issues was able to articulate school and educational rights as a chance to jump the deep gap in inequality.”

Comparative evaluation of similar programs in Mexico and Uruguay

The literature about the effectiveness of delivering free computers to schools is quite limited. One reason may have been that projects have been used to increase political prestige and were losing support from the next government. In Latin America, Uruguay was a forerunner with the plan ‘Ceibal’ as a partner in Negropontes “One laptop per child” campaign. Mexico followed next with the “@aprende” project, which was set up to create an internet platform with support material for using technology at school or at the university, and the MiCompuMX program for introducing computers to basic schools. The following tables show some facts about these programs.

Table 1. Comparison of national programs

Program	Number of computers delivered	Program coverage	Number of trained teachers	Evaluation
Plan Ceibal (Uruguay)	2003 1.000.000 Computers have been delivered	99% of students with laptops and 99% of schools with online access	4000 teachers trained	Under this program it has been possible to universalize access to computers for homes with school-age children. Likewise, the public school has become the axis of digital experience.
MiCompuMX (Mexico)	240.000 computers delivered	The pilot program was implemented in three states: Colima, Sonora and Tabasco	From 2009 to 2012 a total of 11.060 teachers have been trained.	Currently, there are no data on the results of the project or associated initiatives. All these actions are in the process of development and implementation.
Conectar Igualdad (Argentina)	In 2004 100 % of the students have a computer. It is a total of 4.979.682	99,5 % covered	600.000 teachers trained	It is said that there were changes in the way of teaching and the program promotes horizontal communication to improve the teacher/student relationship and to make students more active.

The acceptance of the programs will be increased if the characteristics of the target groups are analysed before the program starts. For example:

- Some of the students, who received a laptop had no or deficient internet connection;
- Down loading of files was too slow;
- The technical support was not sufficiently qualified;
- Teachers were not willing to spend extra time;
- The training sessions were too short;
- The quality of the teaching content was not well integrated with the curriculum.

An important factor for success is a high-speed network infrastructure and well-structured web-portals that contain free downloadable content as well as uploading of user created content. However, perhaps most important is the motivation of

teachers to make creative use of digital facilities. It is interesting to state that there are few research papers that are checking the efficiency and sustainability of the huge Latin American national programs, which aim at reduced exclusion from educational options and to raise the level of computer literacy by introduction of teaching and learning with digital technologies. However, the programs have their own dynamics and are changing and adjusted continuously. The answers given today will be different tomorrow.

Conclusion

Finally, we can conclude that the delivery of netbooks to the students and, by extension to their families was the right decision to take to increase inclusion and to reduce the digital gap.

While schools should not follow the logic of the consumer market, when it comes to thinking about the incorporation

of technologies in educational processes, an important point to consider is the updating of technologies and their consequences in the social dynamics. Today, young people weigh and value mobile devices over other technological artefacts. With this tool they communicate, fall in love, and have fun, play, do banking, work, report and study. For both private and public uses they found only

one technology. In perspective, questions remain, how will education with technologies be in a not too distant future? What new concepts will emerge? What new tools will determine the social inclusion of young generations? Who will determine the educational paradigms: teachers or the consumer market of technologies?

References

1. Laaser W, TolozaEA. The changing role of the educational video in Higher Distance Education. IRRODL 2017;18. Available at: <https://files.eric.ed.gov/fulltext/EJ1138780.pdf> (accessed: May 20, 2019).
2. Koehler MJ, Mishra P. What is technological pedagogical content knowledge? CITE 2009;9:60-70. https://www.researchgate.net/publication/241616400_What_Is_Technological_Pedagogical_Content_Knowledge (accessed: May 20, 2019).
3. Bates AW. Online Learning and disruptive change at the UK Open University 2018. May 2: 2018. <https://www.tonybates.ca/2018/05/02/online-learning-and-disruptive-change-at-the-uk-open-university/> (accessed: May 22, 2019).
4. Segura J, Quinteros L, Mon F. Towards Ubersity? Conflicts and contradictions of the digital university. RIED 2018;21:51-68. DOI: <http://dx.doi.org/10.5944/ried.21.2.20669>
5. Watters A. 2015 Trends. Retrieved from: <http://hackededucation.com/2017/12/20/top-ed-tech-trends-robots-kids> (accessed: May 20, 2019).
6. Watters A. The tech sector does love stories – grand narratives and make-believes and mythologies about revolution and disruption and innovation. <http://hackededucation.com/2018/04/26/cuny-gc> (accessed: May 20, 2019).
7. Prensky M. Digital Natives, Digital Immigrants. By Marc Prensky. On the Horizon. MCB University Press 2001; 9, 5 (accessed May 20, 2019).
8. Ferreiro E. Presentación de Cátedra Emilia Ferreiro. Universidad Nacional de Rosario. <https://www.youtube.com/watch?v=Q8c-v8OwORk> (accessed: May 20, 2019).
9. Bacher S. La Infancia, ¿Conectada? La Nación, Revista. <http://silviabacher.com.ar/articulo3/> (accessed: May 20, 2019).
10. Inter-American children's institute and Organization of Ibero-American states. Agreement of cooperation (2019). http://iin.oea.org/pdf-iin/informe-90/en/Agreement_Cooperation_IIN_OEI.pdf (accessed: May 20, 2019).
11. Library of Congress - Argentina: Constitutional Right to an Education - Law 26,206 on National Education, adopted on Dec. 14, 2006. <https://www.loc.gov/law/help/constitutional-right-to-an-education/argentina.php> (accessed: May 20, 2019).
12. Larghi B. Selogio de un fracaso. La dimensión simbólica del Programa Conectar Igualdad. (Praise of a "failure": The symbolic dimension of

the ConectarIgualdad Program).
JUV;2016:10.
13. Da Porta E. Aprender conectados o
cómo borrar la igualdad por decreto.
Conversaciones necesarias entre

educación, cultura y política.
<https://conversacionesnecesarias.org/2018/05/11/aprender-conectados-o-como-borrar-la-igualdad-por-decreto/>
(accessed: May 20, 2019).

© 2019 Laaser et al; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/3.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.