INFORMATION TECHNOLOGIES AND COMMUNICATION IN COLOMBIAN UNIVERSITIES: EVOLUTION AND FUTUROLOGY

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RESUMEN

La presente revisión sintetiza la memoria histórica de la evolución y prospectiva de las Tecnologías de la Información y la Comunicación (TIC) en la Universidad Colombiana, con el fin de realizar un acercamiento a la comprensión del estado actual y un aporte conceptual que oriente la toma de decisiones, las políticas y los programas en TIC hacia sus tendencias en el ámbito universitario.

Las TIC son sinónimo de modernización, calidad, productividad, mejores servicios y apoyo a los procesos educativos, por ende, algunas universidades intentan ir a su ritmo, ya que consideran que las pone en una situación ventajosa, por lo que es necesario indagar cómo se afrontó este proceso. Esta síntesis siguió la metodología de la Historia de la educación[2]. Las TIC en la universidad colombiana se integraron principalmente en los ejes de docencia y administración mediante la autonomía universitaria, avanzando en cada contexto hacia una e-universidad. Hoy se han materializado algunas de las potencialidades y servicios, se cuenta con políticas públicas y está en crecimiento la modalidad virtual, pero se debe avanzar hacia la tendencia *Universidad 2.0*.

Palabras clave: *Revista Historia de la educación latinoamericana, tecnología de la información, tendencia educacional, enseñanza superior.*

INFORMATION AND COMMUNICATION TECHNOLOGIES IN COLOMBIAN UNIVERSITIES: EVOLUTION AND FUTUROLOGY

ABSTRACT

The current review summarizes the historic memory of the evolution and futurology concerning the Information and Communication Technologies (ICT) in Colombian Universities. This is in order to make an approach to understand the current state and provide a conceptual input that advices decision making, policies and programs regarding ICTs towards its trends in universities.

ICTs mean modernization, quality, productivity, better services and support to educational processes. Therefore, some universities try to be up-to-date because they consider that ICTs gives them the advantage, which is why it is imperative to investigate how this process was faced. This synthesis followed the methodology of the History

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[2] "es una rama de la historia y de la cultura, que tiene por objeto el estudio y el conocimiento de la teoría o el hecho educativo en el tiempo y en el espacio en que tuvieron lugar". Ávila Fernández, Alejandro, Calderón España, María Consolación, Cortés Giner, María Isabel, Montero Pedrera, Ana María. *Historia de la Educación, Cuestiones previas y perspectivas actuales.* (Sevilla: GI.P.E.S, 1996), 60.

of Education[3]. ICTs were integrated in the Colombian universities mainly in the concepts of teaching and management through university's autonomy, advancing in every context towards an on-line university. Nowadays, the potential and services have become real, there are public policies available and on-line modality is increasing, however the *University 2.0* trend must be reached.

Key words: *History of Latin American Education Journal, information and communication technologies, educational trend, higher education.*

AS TECNOLOGIAS DA INFORMAÇÃO E DA COMUNICAÇÃO NA UNIVERSIDADE COLOMBIANA: EVOLUÇÃO E PROSPECTIVA

RESUMO

A presente revisão sintetiza a memória histórica da evolução e prospectiva das Tecnologias da Informação e da Comunicação (TIC) na universidade colombiana, com a finalidade de permitir uma compreensão do estado atual e uma contribuição conceitual que oriente a tomada de decisões, as políticas e os programas em TIC acerca de suas tendências no âmbito universitário.

AS TIC são sinónimos de modernização, qualidade, produtividade, melhores serviços e apoio aos processos educativos, e por causa disso algumas universidades objetivaram desenvolvê-las em seu próprio ritmo, já que consideram que as coloca em uma situação vantajosa, pelo que se faz necessário como se afrontou este processo.

Esta síntese seguiu a metodologia da História da Educação. As TIC na universidade colombiana se integraram principalmente nos eixos da docência e da administração, mediante a autonomia universitária, avançando em cada contexto de uma universidade. Hoje se materializaram algumas das potencialidades e serviços, se conta com políticas públicas e está em crescimento a modalidade virtual, porém de deve avançar para a tendência de Universidade 2.0.

Palavras-chave: *Revista História da educação latino-americana, tecnologia da informação, tendência educacional, ensino superior.*

INTRODUCTION

This reviewing summarizes the historic memory of the evolution and the prospective related to the information and communication technologies in the Colombian universities. This reviewing covers from 1957 to 2010, in order to make an approach about the comprehension and the current state and a conceptual support that can guide to make decisions and direct the politics and programs about ICT, towards the new trends that these technologies carry in the university field.

The university is an institution of historical trajectory that plays a transformative role in society. It is an active topic, therefore it is quite important to inquire how the opportunities and the challenge that the ICT offer and imply were faced.

To integrate the ICT in the university level education has been a complex process, in spite of the strengthening actions carried out during the last years (some of them were influenced by the register, qualified and accreditation processes), for the purpose of optimizing the resources, and to support, improve and innovate the educative processes, in order to transform

[3]"It is a branch of the history and culture that whose objective is the study and knowledge of educational facts in the time and place of their appearance". Ávila Fernández, Alejandro, Calderón España, María Consolación, Corts Giner, María Isabel, Montero Pedrera, Ana María. *Historia de la Educación, Cuestiones previas y perspectivas actuales.* (Sevilla, GI.P.E.S, 1996), 60.

the classroom university level formation which has been linked to a traditional paradigm masterful, therefore, the following questions emerged in the Colombian context: how was the integration process of the ICT in the universities faced by Colombia? Which are the new trends about the implementation of the technologies in the university?

This research followed the steps related to the methodology History of Education, through the location and collection of primary and secondary sources (printed and published media), the design and implementation of a survey for the National Department of planning, in order to examine the tracking national ICT policies. Finally, the sources were organized, categorized, analyzed and interpreted, in order to make an explanatory summary that allows establishing some conclusions.

The reconstruction of the historic- educative background of the ICT in the Colombian university is remitted to the arrival of the computation and internet to the country, the growth of the informatics in the universities, the development of virtual education, the studies, politics and programs led by the Ministry of National Education, the modernization of the educative sector, he e- university[4] and the prospective of the ICT in the university.

1. Beginnings of modern computing in the world and its arrival to Colombia

Modern computing emerged in the late 30s and 40s. During this stage some research projects[5] linked to universities were conducted to demonstrate the feasibility of electronic computers[6]. By then "*it seemed unlikely that many of these bulky, uncomfortable and temperamental monsters come to build outside universities, military installations and government laboratories"*[7].

In the late 50s, these machines had earned the trust of companies and developed thanks to the space race. It was a time of over-optimism about the possibilities offered by computers[8]. Here begins the history of Latin American computing. In Colombia, the experience of universities resulted from actions that took place in the productive sector and in 1957 the first computer entered the country; it was an IBM 650[9] mainframe acquired by Bavaria. The same year

[4] It is understood as "the intensive, extensive and strategic application of the new information, telecommunications and internet technologies (ICTs) to all the activities in a university". Susana, Finquelievich and Alejandro Prince. Universities and ICTs in Argentina. Argetine Universities in the knowledge society (2005), http://www.scribd.com/doc/4940962/Finquelievich-y-PrinceLAS-UNIVERSIDADES-ARGENTINAS-EN-LA (November 20, 2011).

[5] In 1939, the current Iowa State University (USA), the ABC (Atanasoff-Berry Computer) was created, the first electronic digital computer with special purpose, and later at the University of Pennsylvania (USA) they developed the ENIAC (Electronic Numerical Integrator and Computer), the first electronic general-purpose computer completed in 1945. According to Carlos Coello Coello, *Brief history of computing and its pioneers* (Mexico: Economic Culture Fund, 2003) ,160 and 318.

[6] The application of electronics to the information processing evolved from vacuum tubes to transistors (1947), integrated circuits (1958) and microprocessors (1971).

[7] Tom Forester, *High-tech society: the history of the revolution in information technology* (Mexico: Siglo Veintiuno Editores, 1992), 33.

[8] Senén Barro Ameneiro and Alberto Bugarín Diz, *Frontiers of Computer Science* (Spain: Ediciones Díaz de Santos, 2002), 19.

[9] Computer manufactured on an industrial scale in 1953 by the International Business Machines (IBM)

Coltejer acquired one and public enterprises of Medellín and Ecopetrol did in 1958[10].

In other countries the first computers were brought by universities. In Mexico an IBM 650 was installed at the National Autonomous University of Mexico (UNAM) in 1958, its first owner was the University of California in Los Angeles (UCLA)[11]. In Argentina the Faculty of Sciences, University of Buenos Aires acquired a Ferranti Mercury computer that was installed in 1961[12]. It is known as Clementine, according to Sadosky (cited by Correa) *"because through the modulation of a whistling sound it emitted, you could listen Clementine, a popular English song"*[13].

The first two IBM 650 computers that arrived in the country *"were taken to the National University and the University of Los Andes"*[14], specifically to the Department of Electrical Engineering[15] of the latter in 1963, and in these institutions the first programs of this new discipline were created. In the second half of 1966 the National University created the Computer Science Master, first program in Latin America in its type[16]. Later, in 1967, the University of Los Andes founded the Computer Science Engineering[17].

2. Evolution of computer in Colombian universities

In 1966 and 1967 at the National University and the Industrial University of Santander, two IBM/1620 computers were installed[18], which were based on transistors, apart from the fact that third generation computers, based on integrated circuits, made their appearance in the By this time the computers were just a few in the country[19]. Regarding the generation of computer technologies[20] in Colombia, it is important highlighting the Digital Teaching

[10] Álvaro Montes, *"Computers arrived"* in 50 days that changed the history of Colombia (Bogotá: Semana Journal. Editorial Planeta, 2004), 237 - 238.

[11] Daniel Ortiz Arroyo, Francisco Rodríguez Henríquez and Carlos Coello Coello, "Mexican Computers: A brief technical and historical review", *Digital University Journal, Autonomous National University of Mexico*. Volume 9, Number 9 (2008): 5.

[12] Pablo Jacovkis, "Brief review of computing history in Argentina", in web site of the Computing Society of Argentina (2004). http://www.sadio.org.ar/modules.php?op=modload&name=News&file=article&sid=50 (January 29, 2010)

[13] Leonardo Correa, "They called it Clementine", (web site http://edant.clarin.com, 2005) http://edant.clarin.com/suplementos/informatica/2005/08/17/f-00511.htm (September 17, 2010).

[14] Álvaro Montes, , *"Computers arrived"*, 237.

[15] Oscar Guarín, "*ACIS, Memories of Computing in Colombia*", in: Sistemas Journal. Colombia computing memory Edition N° 100. Colombian Asociation of Computer Science Engineers. (2007). http://www.acis.org.co/fileadmin/Revista_100/ED_100_INVESTIGACION.pdf (27 October, 2012)

[16] Oscar Guarín, "*ACIS, Memories of Computing in Colombia*".

[17] University of Los Andes. Website of the Department of Computing Engineering. http://sistemas.uniandes.edu.co/sitio/index.php?option=com_content&view=article&id=65&Itemid=90 (September 17, 2010)

[18] National Bureau of Statistics. First national census of computing resources in the public sector. (Colombia: Editor DANE, 1985), 7.

[19] Luis Uribe, "CODIDAC". *Tekhne Journal of the Engineering,* Faculty No 7. Andrés Bello Catholic University, (2004), 50.

[20] It is important to highlight the Mexican public universities, which in the late 70s and mid-80s designed a great variety of computer systems based on microprocessors.

Computer (CODIDAC) created at the Pontificia Universidad Javeriana from November 1969 to February 1971[21], which was groundbreaking for the time.

In the 70s computers became less bulky, safer, more affordable and faster due to advances in electronics[22] and fourth generation systems, based on microprocessor, appeared. The discipline was growing in the country and interest inside universities grew, so *data centers* started to be created, in the case of the UPTC it was in 1972 in order to systematize academic and administrative work[23]. The Colombian Association of Computer Users (ACUC) was created in 1972 and the Colombian Association of Computer Science Engineering (ACIS) emerged in 1975[24].

From that moment, universities faced on their own the challenge of introducing technology in all areas through university autonomy, which influenced the fact that the integration of ICT and virtualization developed differently in all universities until 2008, when the Guidelines for the formulation of strategic plans to incorporate ICT in Higher Education Institutions (HEIs)[25] was published.

The events in the late 80s and 90s identified by Maldonado were the forums on computing in higher education of the Colombian Association of Universities (ASCUN) and the first Colombian Symposium of computer science, education and training. In 1989 Colciencias, and the University of Los Andes created a journal in educational computing[26]. It is significant to mention Compuexpo 90, which presented the Colombian Museum of Computer Science[27], lectures and seminars supported by universities[28]. In 1990 the American Network of Educational Computing (RIBIE) was born, its node in Colombia is RIBIECOL[29] and is the oldest and largest organization in this area throughout the country[30]. Research groups on the relation education and computing are also created[31]. These facts indicate the expansion in research, updating and generalization of information technology in the country.

The nineties were identified by rapid technological advances. Since computers reached a larger number of people and organizations, the research community grew in size and the

[21] Luis, Uribe, "Projects completed". http://www.scribd.com/doc/20253455/UribeUSBProy1d-Publicar (August 30, 2010)

[22] Technological advances in computing and their adoption continue to cross all sectors through the application of artificial intelligence, nanotechnology, robotics, expert computer systems, among other trends.

[23] Pedagogical and Technological University of Colombia. Rectoral Resolution No. 414 of 1972.

[24] Oscar Guarín, "*ACIS, Memories of Computing in Colombia*".

[25] Written by the MEN in agreement with the group LIDIE, University of Los Andes.

[26] Luis Facundo Maldonado Granados and Paola Maldonado Rey, *New technologies applied to education. State of the art of research, 1990 – 1999*, en States of the Art of Education and Pedagogy Research in Colombia. Myrian Henao Willes y Jorge Orlando Castro (Comp.) (Bogotá, ICFES, 2001), 146 -147.

[27] El Tiempo, "Museum of Computing", *El Tiempo*, Bogotá, 8 de agosto, 1990. http://www.eltiempo.com/archivo/documento/MAM-69828 (February 25, 2013).

[28] Jaime Mejía Mazuera, " What are they for computers", *El Tiempo*, August 8, 1990.

[29] Since 1992 it organizes the Educational Computing Congress every two years.

[30] Luis Facundo Maldonado Granados, "RIBIECOL – 20 years of life". (Proceedings of the International Conference on Computers in Education. Virtual classrooms, instructional design, simulations and cyberculture, Popayán July 14-16, 2010, CD-ROM. RIBIECOL, 2010)

[31] The Laboratory of Research and Development in Education Computing (LIDIE), University of Los Andes, originally conceived in 1985 as Computer Education Group (GIE) and the Group Teaching and New Technologies of the University of Antioquia which dates back to 1986 .

internet connection came into being in Colombia. Likewise distance/virtual education started as in 1992 *"the Monterrey Institute of Technology and Higher Education in agreement with the Autonomous University of Bucaramanga {...} offered distance academic programs (masters), through satellite classes produced in Mexico"*, later (1995-1996) some universities affiliated to the José Celestino Mutis University Network joined this agreement[32].

Act 115 of 1994 established Technology and Computing in the basic level and stimulated computer literacy, despite some flaws in the existing infrastructure for those institutions by that time. This triggered the creation of the Bachelor in Computer Science program[33] whose graduates have gradually linked to the national education system.

3. Internet in Colombia

According to Meneses, in 1986 the University of Los Andes, the National University and the North University began testing for a connection to the global network, but the project was not fully developed. In 1990 the main universities of the country with the support of the Colombian Institute for the Promotion of Higher Education (ICFES) created the Colombian University Network (RUNCOL). It operated in the University of Los Andes, which had the infrastructure to work with the Bitnet network. However, its access was limited and the services this network offered could not be used online[34].

According to the Journal of Engineering at the University of Los Andes, in 1991 the switching to Bitnet II required the request for the handling of ".co" address assignments and domain administration, a procedure that was approved[35]. In 1993, thanks to the national backbone, consisting of the EAFIT, Universidad del Valle and Los Andes, Internet services began to develop locally. In December 1993, delegates from ICFES, Colciencias EAFIT, Universidad del Valle and Los Andes agreed to the creation of the InterRed corporation to manage Internet connection and it was established in 1996. As the University of Los Andes had the technical infrastructure and expertise, it was tasked to set up and start the administration of the first Internet service provider (ISP), so the entrance date of the Internet in Colombia was June 4, 1994[36].

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[32] ÁNGEL, Facundo, " Virtual Higher Education in Colombia". In Virtual higher education in Latin America and the Caribbean. (Mexico: ANUIES-UNESCO, 2004), 193.

[33] It is important to mention the Bachelor of Computer Education at UPTC (Agreement No. 022 of 1994 of the Superior University Council), Bachelor in Elementary Education with emphasis on Information Technology at Minuto de Dios University Corporation (Superior Council Agreement No. 087 of 25 August 1999), Bachelor in Elementary Education with Emphasis in Computing at the University of Magdalena (prior approval under Resolution 3306 of December 7, 2000), Bachelor of Information Technology and Broadcasting at the University of Córdoba (Resolution 3311 of December 7, 2000), Bachelor of Computer Science at University of Nariño and Bachelor of Communication and Computer Education at the Technological University of Pereira.

[34] Arnaldo Meneses, *Telecommunications in Colombia in the early 90s.* (Communications Regulatory Commission of Colombia, 2000). http://www.crcom.gov.co/images/stories/crt-documents/BibliotecaVirtual/publi_sector90/LibroTelec.pdf (June 15, 2010)

[35] Organizations wishing to register a domain ".co" should do so through the University of Los Andes, this service was provided for 18 years until February 7, 2010.
http://www.uniandes.edu.co/la_universidad/Informatica.php

[36] Fernando, Salcedo, *" From the academy, internet for Colombia"*. In: Journal No. 23, University of Los Andes (2006): 148-149.

In late 1995, some universities[37] had already published web pages[38]. According to Valencia[39], from the introduction of the internet until early 1997, most of the users were in the universities of the country's major cities[40]. In late 1999, 77% of Internet use was concentrated in large companies, universities and government bodies[41]. The above shows that universities are key players in the internet access and dissemination.

4. Virtual Education in Colombia

According to Angel, the year 1998 could be seen as the starting point of virtuality in Colombia, as two institutions[42] began to offer undergraduate programs supported in virtual technologies[43]. By 2002, according to an analysis made by Zapata of a sample of universities on Colombian educational experiences based on internet, there was *"a clear trend in higher education institutions to work in isolation and there are very few that make alliances including some which have agreements with foreign universities to offer academic programs"*[44].

Later, face-to-face universities and distance universities with virtual campus expanded, as a political support to educational processes, so departments with interdisciplinary professionals (programmers, graphic designers, educators, and others) are created to lead virtual education projects. Some cases of committees and units are:

Table 1. Some committees and virtual education units (2003-2004)

University	Name of the committee o department	Year of creation
Pontificia Universidad Javeriana	Center of Education Supported by New Technologies (CEANTIC)[45]	2003
Pedagogical and Technological University of Colombia (UPTC)	Virtual Education Advisory Committee[46]	2003

[37] It is important to mention universities such as: Los Andes, National, Cauca, Valle, Antioquia, EAFIT, Javeriana, Antonio Nariño and Ibagué University Corporation.

[38] Carlos Manjarres, " Internet Presence in Colombia". El Tiempo Newspaper, Bogotá, November 20, 1995.

[39] A study at the Universidad Javeriana in the year 1998 emphasizes the use of internet for communication between colleagues, friends, family and as an information tool, not only academic but more for entertainment. Some users learned to use it on their own and supported by their friends. Technical difficulties put many people away from computers and Internet and knowledge of other languages hindered their interaction with people from other countries and information searches.

[40] Juan Carlos Valencia Rincón, "Internet in Colombia. Hallucination, information and communication. (Master Thesis in Communication. Pontificia Universidad Javeriana. Faculty of Communication and Language, 1998)

[41] Meneses, *Telecommunications in Colombia in the early 90s.*

[42] According to Facundo Angel, one in Nueva Granada Military University (government institution) and three at the North Catholic University Foundation (a private institution), the first fully virtual university of the country. The National University also initiated the development of online courses and the University of Los Andes started a pilot project called University of Los Andes Interactive System of Courses (SICUA), space for teachers and students to share information, agree to the programming and content of courses.

[43] Ángel, " Virtual Higher Education in Colombia", 193-194

[44] Donna Zapata Zapata, *Contextualizing virtual learning in higher education*. (Bogotá: ICFES, 2002), 40. Retrieved from: http://blade1.uniquindio.edu.co/uniquindio/ntic/lineamientos/nuevos%20libros/arc_88.pdf (May 21, 2012)

[45] Pontificia Universidad Javeriana. Rector's Report to the Board of Regents 2003. (Bogotá, editorial Pontificia Universidad Javeriana, 2003), 30.

[46] Pedagogical and Technological University of Colombia. Rectoral Resolution No 2848 of 2003.

Technological University of Pereira (UTP)	Univirtual[47]	2004
National University of Colombia (UNAL)	Initially the Virtual University program (1999-2004) National Virtual Academic Services[48].	2004

Source: Author

The actions of these departments have influenced the entire institution. They are different in infrastructure, policies, incentives, partnerships, experience monitoring and institutional support, along the vision of offering fully virtual programs. With its implementation the pedagogical model changes in each context and with different results. In the traditional model, virtual accompaniment is an added value and some universities have mechanisms to guarantee its quality.

According to the European project EQUIBELT[49] there is concern that *"this technology integration is not assuming an innovation process, but being attached to traditional learning situations"*[50]. Even though, it is necessary to consider that ensuring quality procedures and materials will positively affect educational processes in time flexibility, space and teaching models, so it would not be the same.

Currently, some universities[51] have at least an undergraduate program in virtual mode and / or distance-virtual[52]. Continuing education courses and postgraduate courses are supported with extensive ICT. The trend is not temporary as it intends to expand educational opportunities. This is consistent with the policies of the Ministry of National Education, that is encouraging virtual courses to improve its coverage indicators since 2003. In 2008, through the E-learning 2.0 Colombia Association, it began to transform 18 distance professional technical and technological programs to virtual programs[53], this strategy was also reflected in the National ICT Plan 2008-2019.

In June 2010, the Ministry of National Education launched a virtual higher education campaign, understood as *"an alternative training that enables people to make their education in a place different from the classroom: cyberspace"*[54], which at that time had *"147 programs,*

[47] Martha Isabel Tobón Lindo, et al., *Teacher training to incorporate ICT into teaching and learning processes. A proposal for the Technological University of Pereira* (2010). http://www.slideshare.net/misabell/el-docente-y-las-tic-4476500 (August 31, 2010).

[48] National University Of Colombia. Agreement Number 034 of 2004 University Council.

[49] Education Quality Improvement by E-learning Technology

[50] Cited by Carlos Castaño Garrido, et al., "Elearning 2.0". In: New pedagogical scenarios for digital learning. University of the Basque Country. (2009). http://ocw.ehu.es/ciencias-sociales-y-juridicas/nuevos-escenarios-pedagogicos-para-el-aprendizaje-digital/bloque-3-estrategias-de-aprendizaje-2-0-para-la-innovacion-pedagogica/tema-1-elearning-2.0 (July 02, 2010)

[51] highlights the Fundación Universitaria Católica del Norte, la Universidad Autónoma de Bucaramanga , Fundación Universitaria CEIPA, la Pontificia Universidad Javeriana, la Universidad Cooperativa de Colombia y el Politécnico Grancolombiano.

[52] In the literature there was no consensus on its definition. We can say that it is a type of distance learning that combines face-to-face meetings and support of ICT in learning processes.

[53] El Universal Journal, "Ministry of Education launches campaign for virtual higher education", El Universal, July 1, 2010. http://www.eluniversal.com.co/v2/cartagena/educacion/ministerio-de-educacion-lanza-campana-de-educacion-superior-virtual (August 8, 2010).

[54] www.colombiaaprende.edu.co, "What is virtual education?" (n.d.). http://www.colombiaaprende.edu.co/html/productos/1685/article-229097.html (April 22, 2012).

with over 80 percent of virtuality."[55] This formal support intended to increase the reception of this educational modality and overcome the debate about its quality.

5. Studies of the Ministry of National Education

The study *Virtual models of Colombian HEIs*[56], launched in late 2005, identified four types of institutions regarding the use of ICT: 13% vanguard; 13% cooperative; 37% self-sufficient, and 37% skeptical[57], *"in the first group most are private, in the latter group most are from the public sector"*[58].

Another study was the *Design of guidelines for the formulation of strategic plans to incorporate ICT in Colombian HEIs*, which in 2008 conducted a pilot process to support 28 institutions and expanded to 64 HEIs in 2009[59]. Some countries generated a system to annually review the progress of ICT in universities in the United States since 1990[60], in the UK since 1996-7[61] and UNIVERSITIC[62] in Spain since 2006. Colombia still does not practice the annual review of this advance.

6. Policies and programs led by the Ministry of National Education

In Latin America, the first public policies on issues of telecommunications and computing date back to the years 1960-70, especially in Brazil and Mexico[63]. In Colombia, the first state policy in the long term[64] appeared in 2000 and was called *Connectivity Agenda: The Jump to Internet* (CONPES 3072). According to Rincon it was formulated based on the program

[55] Ministry of National Education, "Balance of the Educational Revolution 2002 – 2010". (2010). http://www.mineducacion.gov.co/1621/articles-231469_archivo_pdf_discurso.pdf (08 June, 2010)

[56] Was applied to 171 public and private institutions between (techniques and technology, colleges and universities), taking into account aspects such as: Institutional organization, learning methodologies and collaborative networking with other national and international HEIs.

[57] Ministry of National Education," Technologies as strategic allies of higher education" (2006?). http://www.mineducacion.gov.co/cvn/1665/fo-article-103872.pdf (April 19, 2012)

[58] Carolina Botero, "Seminar of the Ministry of Education in Colombia Strategies for Using Learning Objects and High Speed Networks" (2006). http://www.karisma.org.co/carobotero/index.php/2006/07/27/seminario-del-ministerio-de-educacion-en-colombia-estrategias-para-el-uso-de-objetos-de-aprendizaje-y-redes-de-alta-velocidad/ (April 19, 2012)

[59] www.colombiaaprende.edu.co, "ICT Plans Strategy". Ministry of National Education" (n.d.). http://www.colombiaaprende.edu.co/html/directivos/1598/article-201182.html (August 20, 2010)

[60] It is called "National Survey of Computing and Information Technology in American Higher Education"

[61] "Higher Education Information Technology Statistic (HEITS)

[62] It makes an analysis on strategic axes: teaching and learning, research, university management and information, training, culture and organization of ICT.

[63] Martin Hilbert, Sebastián Bustos, João Carlos Ferraz, National Strategies for the Information Society in Latin America and the Caribbean. (United Nations publication, 2005), 9.

[64] Chile and Argentina are the first countries to establish decrees in 1998, Brazil in 1999, Colombia and Venezuela in 2000, (Hilbert, Bustos and Ferraz, 28).

developed by the Government of Canada (*Connecting Canadians*) and adjusted to the Colombian social, economic and political reality[65].

The aim of CONPES 3072 was *"promoting social and economic development of Colombia by the mass use of information technologies"*[66], a deterministic look to technology as an engine of change. It was initially coordinated by the Presidential program for development of ICT[67], but after the suppression of its functions, they were assumed by the Ministry of Communications[68]. According to Vanegas, this change was due to the economic factor, since the communication fund was who had the money[69].

CONPES documents state recommendations coming from agreements which make national entities responsible for articulating them to the national development plans. Thus the CONPES 3072 contains the commitments and the responsible agents, but it did not establish the duration and monitoring indicators and interviewees agree that it is still in force[70]. It was prepared by the Ministry of Communications and the National Planning Department[71].

CONPES 3072 has not been followed by compliance monitoring through SISCONPES[72] since by that time this methodology had not been implemented yet[73]. Through the Management and Monitoring System to Government Goals[74], some programs like RENATA, Computers for Education and Government Online have recorded its progress.

In the last decade some major ICT programs focused on higher education and conducted by the Ministry of National Education (MEN) were: the Learning Objects National Bank, Tutor Virtual Network (RVT) and the National Network of Advanced Technology (RENATA), which were realized officially from 2006 to 2007 and generated an enabling environment for its use by universities at the time[75].

Currently, policies as the *Vive Digital* Plan[76] are oriented to the growth of Virtual Education, RENATA expansion and Educational Innovation System[77]. This can be summarized in

[65] Erick Rincón Cárdenas, Law Manual on e-commerce and Internet. (Bogotá: Editorial Universidad del Rosario, 2006), 321.
[66] Colombia. CONPES 3072 Document of February 9, 2000. National Council for Economic and Social Policy. National Planning Department. Ministry of Communications, 12.
[67] Colombia. Decree 127 of 2001 of the Republic Presidency.
[68] Colombia. Decree 3107 of 2003 of the Republic Presidency.
[69] Interview to Vanegas Murcia Eliecer, Bogotá 2011, 6 de October de 2011.
[70] Interview to Vanegas Murcia Eliecer.
[71] Martin Hilbert, Sebastián Bustos, João Carlos Ferraz, *Estrategias nacionales para la sociedad de la información en América Latina y el Caribe*, 50.
[72] It is a tracking system that facilitates and promotes accountability commitments of CONPES Documents.
[73] Interview to Vanegas Murcia Eliecer, Barbosa Adriana, González Rosario, Bogotá, october 6, 2011.
[74] see http://www.sigob.gov.co
[75] Fredy Yesid Mesa Jimenez y Ángela Marcela Soler Fonseca "Public policy in Information Technology and Communication and its impact on the Colombian university (2000-2008)" In Memories of the 2nd National, 1st International Research and Pedagogy Congress. Perspectives, challenges and changes in educational contexts. Master in Education UPTC, (2011), 270.
[76] In the National Development Plan 2010 - 2014, the ICT plan is called "Vive Digital".
[77] Ministry of Information Technology and Communications, "Vive Digital Colombia. Document of the Plan. Version 1.0", (2011), 73-74.

actions on infrastructure, content, qualification and appropriation, which have been recurrent topics within the guidelines of the Ministry of National Education.

7. Technological modernization of the education

The *Education Revolution*[78] (2002-2010), characterized by the continuation of neoliberal education policies, proposed to improve efficiency in the education sector, so that 90% of the Ministry of Education processes are supported by information systems, that is why it is a leader among state entities regarding the Government Online policy[79].

Higher education and Ministry of National Education are articulated through the following systems: SNIES[80], that manages information and statistics, SPADIES[81], which *"helped to generate actions to reduce the dropout rate by cohort from 50% to 45% between 2002 and 2009"*[82], the SACES[83], which allows to make qualified registration procedures and offers an information system to track higher education graduates[84].

Technological modernization of the education is widespread, influenced partly because ICTs are necessary to meet the mission functions, to achieve coordination between institutions and to carry out the competition policy and economic rationalization. For that reason, despite its high price, very few oppose the integration to it.

8. E-university in Colombia

From the very beginning the use of ICT in universities was more focused on optimizing administrative work[85], today it has spread to teaching, research and extension[86]. This is usually done through a university planning to develop ICT developments at the institution. In some universities the integration between its information systems is better, but generally they have been looking forward to it for years.

Some universities have changed their services[87] using ICT, influenced by an idea of cost reduction in advertising, internationalization and efficiency of some processes. Another example of its use was the setting of non-contact sessions of the National University of

[78] Name given to the education sector by the national government in the national development plan 2002- 2006.
[79] Ministry of National Education. "Balance of the Educational Revolution 2002 – 2010".
[80] Information System for Higher Education
[81] System for the Prevention and Analysis of Dropout in Higher Education Institutions
[82] Ministry of National Education. "Balance of the Educational Revolution 2002 – 2010"
[83] System for Quality Assurance in Higher Education
[84] National Council For Accreditation, The system of continuous improvement of the National Council for Accreditation (2009). http://www.cna.gov.co/1741/articles-186379_recurso_1.pdf (November 22, 2011)
[85] The notable administrative use must be labeled as favorable as it has forced greater digital literacy of the academic community.
[86] Some examples are the use of intranet and information systems for the management of students, professors, graduates, bibliographic information, research, evaluation of teachers and financial accounting systems, among others, as a result of the expansion of ICT to all areas of the university.
[87] Such as electronic payment to suppliers, purchases online, electronic advertising, sending electronic brochures to program applicants of specialized databases (Mailing), multimedia spaces with live broadcasts, sale of books and magazines and registration payment online. Distance and virtual universities have a broader portfolio of services including attention online, virtual counseling and financial chat.

Colombia University Superior Council, to be made by telephone or electronic means when the urgency of an issue warrants it[88].

In general, the widespread use of ICT services, multimedia, internet and virtual campuses have changed some academic-administrative processes and how they relate to individuals and educational institutions. It can be summarized that ICT plays a vital role in meeting the mission functions of the university in the society of information and knowledge.

9. Future of ICT in the university

The new paradigm of ICT application in college is *University 2.0*, where Web 2.0 and user attitude make it a social, collaborative, participatory, interactive environment with and open content to educational services[89]. Another technology is whiteboards[90], which are incorporated in Spain, UK and in Latin America, Mexico is developing a project to equip 300,000 classrooms[91]. In Colombia, according to Smart, more than 1,100 digital classrooms have been installed in 2010, (70% in public schools and the remaining 30% in private schools and universities)[92]. These scenarios should pedagogically adapt to the context in order not to fall behind.

CONCLUSIONS

In Colombia, the private company pioneered the arrival of the computer science, which happened when this discipline had decades of progress all over the world. With few projects in design and construction, from the beginning the country was dependent and consumer of these technologies. The first computers in the academia boosted the first undergraduate and postgraduate programs and with the emergence of computer centers, integration starts at some universities since the late 60s and 70s. Since then, there have been important investments in infrastructure, qualification[93], pedagogical integration, among others, by means of university autonomy.

The interest of universities in mainstreaming processes caused it to be one of the actors of the internet and its spread. It also made it one of the research, updating and generalization means of computing.

The integration of ICT in universities was diverse in strategies, plans, policies and, in some cases, improvisation, which generated inequalities in educational and technological appropriation despite the growing and extensive incorporation. The widest and more evident task has been developed in virtual education at traditional and distance learning institutions.

[88] National University of Colombia. Agreement number 027 of 2005.

[89] Fredy Yesid Mesa Jiménez, "Information and Communication Technology in the University: Prospectives 2.0". In: Pensamiento y Acción Journal. Volume 10 N° 17. Pedagogical and Technological University of Colombia, (2010), 105-110.

[90] resource that allows you to annotate, draw and develop a teaching session with the support of interactive digital content (Alonso et, al, 2009)

[91] Alonso García, Catalina et al., Digital Whiteboard. (Spain,:Cultivalibros Editor, 2009), 9.

[92] Colombia Digital, "Colombia in the age of digital classrooms". (2010). http://www.colombiadigital.net/index.php?option=com_content&view=article&id=370:colombia-en-la-era-de-las-aulas-digitales&catid=75:apropiacion-tic&Itemid=274 (August 15, 2010)

[93] Sometimes focused on an instrumental, not pedagogical use of technology (which is needed).

Some obstacles have been overcome and there are national guidelines and policies now, this was a failure for decades. ICTs continue to influence each context transforming roles, learning environments and teaching models.

During the last decade modernization of education is widespread in order to meet the missionary functions, achieve the coordination between institutions, optimize costs and improve competitiveness and productivity. Some programs, studies and policies show the intention of strengthening the virtual mode looking to improve coverage indicators. There is an increasing digitization of the main axes of the university and the academic community is increasingly using it. Even though, there is a need for developing policies and strategies to ensure progress towards web 2.0 and University 2.0.

More regular research is needed on the progress of ICT in the Colombian university in order to assess the effects on quality and innovation in education. It is important to make studies to recover the historical memory and the role of universities, so that new generations and society value their contributions to education and development.

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