

# Information and Communication Technologies (ICT) and Their Relation to Academic Results Indicators in State Public Universities in Mexico

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## Abstract

We present an analysis regarding Information and communication technologies (TIC) and their relation with indicators of academic results in bachelor's degree programs offered in state public universities in Mexico. This work is non experimental, cross-sectional, and correlational. The goal is to determine significant relations between variables: educational programs that incorporate telematics in their programs and courses of study, qualifications, withholding rates, completion rates, professional integration, along with graduates and employers satisfaction. The data is formed by 58 universities that presented their Program of Quality Strengthening in Education Institutions (PROFOCIE) projects before Ministry of Public Education (SEP) in 2015; and were processed in the statistic package SPSS, obtaining correlation coefficients. These results showed significant relation to withholding rates and student and graduates satisfaction, even though a significant relation wasn't found in degree indicators, completion rates, and professional integration.

**Keywords:** ICT, academic results, education policies, higher education

## 1. Introduction

The improvement of education quality in Higher Education Institutions in Mexico, particularly the public state universities—in the last federal administrations and the one in motion, has been promoted by public policies promoting the acquisition of extraordinary resources for the enhancement of its performance, competing to gain them. For this, within the context of Sectoral Educational Programs, it has promoted the formulation of Integrating Programs of Institutional Strengthening (PIFI) as the main tool to induce a change in the public system of higher education, actually integrated to the Program of Quality Strengthening in Education Institutions (PROFOCIE). In this context, this work analyses telematics incorporation indicators of academic results incorporated in the PIFI projects of SPU, that were subject before the Ministry of Public Education (SEP) in 2015. The purpose is to know the significant relations of such indicators and their influence in the good quality of education programs of bachelor's degree level offered (PROFOCIE, 2014).

One of the aspects to consider for the public policy regarding higher education, is the implementation of Information and Communication Technologies (ICT), being constituted as one of the factors to consider in evaluations—internal and external of Higher Education Institutions (IES), being the availability of technological resources a fundamental indicator to measure quality of services they offer. With ICT and IES, they face the challenge of improving their education, as well as diversify and amplify their education offer. Thus, this research is set out from the question “What is the relation of the incorporation of information and communication technologies in the academic results of State Public Universities in Mexico?” We establish the objective of describing significant relations of such indicators and their influence in the quality of education programs of bachelor's degrees offered. This is based on the assumption that the incorporation of environment telematics and the development of bachelor's degree programs of these institutions of higher education. Understanding telematics and teleinformatics as the result of a union produced between computer and telecommunications techniques. It is the fusion of telecommunications and computer science, and it studies the use of telecommunications to enrich the possibilities of computer science, meaning, the use of long distance communication media for computer connections (Pérez & Gardey, 2014).

This work is formed from the UNESCO statements, of federal policies published by SEP through its sectoral education programs (PSE) 2013-2018, the PROFOCIE, and ANUIES statements; along with authors that have worked in the matter, such as (Herrera, 2009; Marqués, 2007; Belloch, 2012; Buelna & Castro, 2009; Arredondo, López, & Llórenz, 2015).

The great potential of ICT has supported that these grant a big part of their budget to the acquisition, maintenance, and update of computer equipments. ICT are an essential component in strengthening of higher education in Mexico, transforming their environment of action, affecting the process of communication and acquisition of information; opening infinite possibilities of access and generation of knowledge; taking great relevance in the education process gradually adding to their task. Their incorporation to higher education obeys their great communication capacity, to which they offer easy and fast access to infinite document resources, which take part from the daily practice of communication and interaction that young people share with their social environment. Their relevant functions consist in the fact they are a mean of expression and multimedia creation; a communication channel, collaboration, and exchange; an instrument to process information; an open source of information and resources; a cognitive instrument; and instrument for administrative management and tutorial; a diagnosis tool; a didactic mean; generator of new formative scenarios; and a ludic mean for cognitive development, for students, as well as teachers and administrators (Herrera, 2009; Marqués, 2012, p. 7).

ICT are the group of technologies that allow the access, production, treatment, and communication of information presented in different codes (text, images, sounds, etc.); the most representative element of new technologies is, without a doubt, the computer and, more specifically, Internet (Belloch, 2012a); they can be defined as “*Technologies for the storage, recovering, processing, and communication of information*” (Belloch, 2012b, p. 2). The applications of ICT in the education area have been to improve the training of the university community (students, and investigators) through Internet, virtual campus, the computerized management of files or education content, electronic platforms, cyber portal, or *e-learning* through blogs and wikis, cyber magazines, among others (Buelna & Castro, 2009, p. 3).

Regarding quality in higher education, ICT have contributed in the acquisition of new technology skills, promoting digital alphabetization; getting new ICT instruments for education tasks; suggesting the need of continuous training of teachers; and creating new environments of virtual learning (Marqués, 2012). The quality of higher education is a priority of Mexican federal government strategic policy, this leads to observe the significant way in which its acquisition and use provides the good performance and competitiveness of IES. The quality of higher education nowadays relies on the evaluation of IES functions, such as the evaluation of the education institution through PIFI. The evaluation of quality was made taking into account the IES scientific productivity; but nowadays, it implies students, teachers, researchers, departments, institutions, and the rest of the personnel involved in the university life. The universities are forced to implement programs of global improvement in order to compete with other IES; here, the role of ICT is basic (Buelna & Castro, 2009).

The actions regarding the implementation of ICT in higher education, in an international context are promoted through recommendations of organisms, such as UNESCO. The quality and pertinence of education, as well as the incorporation and use of ICT in the process of teaching-learning are the problems to face in education institutions in the XXI century (Arredondo, López, & Llórenz, 2015). In the *World Conference of Higher Education*, held in Paris, 1998, the contribution of TICs to quality and pertinence in the management of information and knowledge done in the area of higher education was recognized. In its section titled *Forging a New Vision of Higher Education-From Vision to action*, in Article 12 regarding potential and challenges of technology, it highlights that accelerated progress of new technologies of information and transmission of knowledge will continue to transform in their elaboration, acquisition, and transmission of the latter, allowing the renovation of courses content and teaching methods, and the enlargement of access to higher education; it also mentions that IES must make the most of ICT potential, seeking the quality and high levels in education practices and results that they offer (UNESCO, 1998). In the *Declaration of Quito regarding the Role of Universities in an Information Society*, it highlights the support to modernization of higher education, through the promotion of changes in paradigms of thought and action, in order to guarantee a better and bigger access to knowledge, improving coverage, high quality, social pertinence, considering the potential that new ICT have for education, and suggests the permanent evaluation of their contribution in academic processes (UNESCO, 2003).

In Mexico, the Federal Government, in its *National Development Plan 2013-2018* (SEP, 2013a), exposes the route of the Federal Government in order to achieve its goals; in the specific case of education, the goal is *Mexico with Quality Education*. In this area, it mentions the strengthening of the Mexican Education System to face the needs of a globalized world, and the effective use of ICT as an essential component in this process. In order to achieve these PDN goals, the Federal Government, through its Sectoral Education Program 2013-2018

(PSE) points out, as one of its goals, the relevance of strengthening of quality and pertinence of higher education (SEP, 2013b). Regarding its objective of quality strengthening and pertinence of education, in order to contribute to the country's development, it considers TICs as a fundamental element; it points out that these have been introduced in higher education, allowing the enlargement of offer and diversify the models of education attention, and being highly useful in information processing, even though it recognizes that the advance in its use is not enough. It also points out the demanding of considering essential elements to its implementation as technological platforms investments, working with the teacher communities, checking the pertinent rules, promoting the research regarding the use of technologies and results evaluation (SEP, 2013b, p. 30).

One of the strategies considered by PSE in order to achieve this objective is to make the most of ICT to strengthen higher education (SEP, 2013b, p. 52), promoting the development of open education offer and online, in complete programs, and for specific classes; to promote the incorporation of teaching new technological resources; to work with teacher communities the programs of diffusion and training in order to use ICT in education processes; to promote the pertinent regulations so the open and long distance education can provide services and support to students and teachers; to promote licensed and multidisciplinary research of the use and development of technologies applied to education; to create a strategy of monitoring and result evaluation of operating academic programs in non-traditional and mixed school curriculum; to use ICT for the training of teachers, administrators, and support personnel in traditional, non-traditional, and mixed school curriculum; to establish general application criteria that simplifies the development of online learning units; and to strengthen the academic coordination mechanisms and education monitoring into the schools with education offers in non-traditional and mixed school curriculums. Another strategy is to create programs so the schools can have the required computer equipment, equipment for workshops and labs, and Internet; and to develop the needed tools for their maintenance (SEP, 2013b, p. 53).

In the document, *Study about the use of Information and Communication Technologies for the virtualization of Higher Education in Mexico* (ANUIES, 2003), ANUIES points out the need for the higher education system to be radically transformed, responding with opportunity, equity, efficiency, and quality to the demands made by transformations of national and international environments, as well as the society demands in the country (ANUIES, 2003, p. 12). One of the actions proposed mentions that, in order to strengthen the Mexican higher education system, it must lean on the use of ICT in a way they allow a continuous and independent learning.

For the improvement of higher education, the Federal Government leans on the Program of Quality Strengthening in Education Institutions (PROFOCIE), is a strategic mean used to grant extraordinary financial resources and the integral assurance of quality of education offer and services that IES offer (PROFOCIE, 2014). The tool used by PROFOCIE is PIFI. This is a SEP strategy to help IES achieve better quality levels in its education programs and services they offer. Through this program, institutions receive resources in response to priorities that derive from a participative planning strategy. Their central axes are the concepts of capacity, academic competitiveness, and innovation. The help obtained from this program are issued to the IES through integrated projects formulated from an exercise of Strategic Planning that integrates the Institutional environment, of the Higher Education Dependencies (DES), and Institutional Management. Nowadays, the federal government continued the strategy of the two past administrations, adding to its Sectoral Development Program 2013-2018 the review of the structure of extraordinary funds to assure they are tools to strengthen higher education (PIFI, 2015).

## 2. Method

In order to achieve the objective of this analysis, a quantitative research was carried out, with a non-experimental research design, cross-sectional, correlational (Hernández et al., 2010), 58 UPE were analyzed and their PIFI was evaluated, during 2015, before the Under-Ministry of Higher Education of SEP. The PIFI indicators analysis was carried out, organizing and processing data in the Statistic Package for Social Sciences (SPSS); the significant relations ( $r$ ) of indicators were obtained. For this analysis, the variables of telematics incorporation of the environment were considered, along with the sustainable development in research programs and the indicators related to withholding rates, professional integration, completion rates, graduation rates, and indicators of graduates and employers satisfaction, as well as the opinion of society regarding the results of the higher education institution.

### 3. The Results of Correlation between Education Programs That Incorporate Telematics of the Environment and Sustainable Development in Their Plans or Courses of Study and the Academic Results of State Public Universities in Mexico, 2015

The results of correlation between variable Education Programs (PE) that incorporate telematics of the environment and sustainable development in their course of study and academic results, are considered indicators associated to withholding rate, professional integration, completion rates, graduate rates, and satisfaction indicators of UPE in Mexico in 2015 (PROFOCIE, 2014), show the following relations:

In the correlation of education program indicators that incorporate telematics of the environment and sustainable development in their course of study and their relation with and withholding rates, the results show a relation with indicators percentage of a PE with a withholding rates, from 1st to 2nd year, superior to 70% of .155, on a withholding rate by generation cohort of Cycle A from 1st to 2nd year, of .055, and on cycle B show a negative relation of -.463 (see Table 1). Regarding the relation with *professional integration indicators*, the study shows a relation with PE in which 80% or more of their graduates got a job in less than six months after graduating, of .263, a relation with PE in which 80% or more of their graduates with degree carried out a work activity during the first year after graduating, and matched or had a relation with their studies, of .226, and with the bachelor's degree graduates that got a job in less than six months after graduating, of .253 (see Table 1).

Table 1. Correlation structure. Education programs that incorporate telematics in the environment and the sustainable development in their course of study, and their relation with education programs on withholding rates, 2015

ICT indicators of PIFI		
PIFI withholding rates indicators		Percentage of education programs that incorporate telematics of the environment and sustainable development in their course of study
Percentage of TSU education programs and Bachelor's degree on a withholding rate, from 1st to 2nd year, superior to 70%	$r$	.155
Withholding rate percentage by generation cohort from cycle A; from 1st to 2nd year in Bachelor's degree	$r$	.055
Withholding rate percentage by generation cohort from cycle B; from 1st to 2nd year in Bachelor's degree	$r$	-.463
Education programs percentage in which 80% or more of their graduates got a job in less than six months after graduating	$r$	.263
Education programs percentage in which 80% or more of their graduates with degree carried out a work activity during the first year after graduating and it matched or was related with their studies	$r$	.226
Percentage of Bachelor's degree graduates that got a job in less than six months after graduating	$r$	.253

\*PIFI, integral program of institutional strengthening; education programs TSU, university senior technician.

In correlation with education programs that incorporate telematics of the environment and sustainable development in their course of study with completion rates and graduate indicators in bachelor's degrees results show a relation of .299 with completion rates by generation cohort for cycle A, and -.333 for cycle B; the relation with graduates by generation cohort for Cycle A during the first graduate year of Bachelor's degree was of .084, and in Cycle B a negative relation of -.263; and the percentage relation of graduate students with Bachelor's degree that carried out a work activity after graduating and it matched or was related to their studies of .258 (see Table 2). In correlation with *satisfaction indicators*, the results are -.028, with graduate satisfaction of -.062, and employers satisfaction with students performance is -.312, and the relation with favorable opinions about education programs of the Institution is -.213 (see Table 2).

Table 2. Main correlation. Education programs that incorporate telematics of the environment and sustainable development in their course of study and their relation with completion and graduation rates, 2015

ICT indicators of PIFI		
PIFI withholding rates indicators		Percentage of education programs that incorporate telematics of the environment and sustainable development in their course of study
Graduate percentage (completion rates) by generation cohort of cycle A; in bachelor's degree	<i>r</i>	.299
Graduate percentage (completion rates) by generation cohort of cycle B; in bachelor's degree	<i>r</i>	-.330
Percentage of graduate students by generation cohort of Cycle A; during the first year after graduating from Bachelor's degree	<i>r</i>	.084
Percentage of graduate students by generation cohort of Cycle B; during the first year after graduating from Bachelor's degree	<i>r</i>	-.263
Percentage of students with degree that carried out a work activity during the first year after graduating and it matched or was related with their studies	<i>r</i>	.258
Student satisfaction percentage	<i>r</i>	-.028
Graduates satisfaction percentage	<i>r</i>	-.062
Satisfaction percentage of employers regarding graduates performance	<i>r</i>	-.312
Percentage of favorable opinions regarding the Institution PE results, with a representative sample of society	<i>r</i>	-.213

\*PIFI, integral program of institutional strengthening.

#### 4. Conclusions

The results of article contribute allow the development of education politics regarding education evaluation in state public universities in Mexico, specifically their own tool for higher education financing of this programs development (PIFI), specifically in 2015, in its correlation indicators among telematics variable implementation, and education programs and their relation to academic results indicators, specifically with indicators associated to withholding rates, professional integration, completion rates, graduation rates, and satisfaction indicators in State Public Universities in Mexico. Relations derived from the results are under 0.5. ICT relations with professional integration, completion rates, and graduation rates were negative. The highest correlation is with the completion rates indicators with a negative relation of -.330 in Cycle B and .299 in Cycle A; and with the indicator for employers' satisfaction regarding graduate students performance relation of -.312. It is shown that, even with the great utility of telematics and education, and as an initiative of federal politics regarding higher education to boost quality of higher education, a null impact in academic results in State Public Universities in 2015 is observed. Even though nowadays its implementation is indispensable, it is still observed that it has a long way to go in order to achieve the implementation of telematics in education programs so it can have a significant impact in Bachelor degree's academic results level, and, hence, in their quality, regarding PIFI.

It is recommended, however, to continue doing analysis where they can evaluate the relations of different indicators associated to information technologies with program indicators, academic processes, including academic capacity indicators. It is also pertinent to monitor the behavior of these indicators in a retrospective and prospective way to corroborate their impact on the last decades and their future impact; public policies regarding higher education, in order so the implementation of telematics in education programs can be significant in higher education quality. The analysis of the pertinence of ICT acquisition, for quantity and characteristics, and its consistency with the needs that the university context poses is recommended, is important this paper got objective of quality of higher education in Mexico.



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