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Leading Change in Educational Institutions for Technology Adoption in Latin America

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ABSTRACT

Information and Communication Technologies (ICT) have become increasingly relevant in most work environments and this tendency is expected to continue over time. Therefore, educational systems around the world have made efforts for the acquisition and use of technology. This study aims to identify representative ICT integration programs on education present in recent decades in Latin America, as part of the interpretation and adaptation of public policies to the context. Bibliographic techniques were used to analyze the trends that have been followed in the region in terms of educational management for the adoption of ICT. As a result, more than 70 articles from scientific journals, four databases and three government websites were analyzed. They evidence an awareness of the relevance of ICT for innovation, and the existence of strategic programs for the reduction of access and use gaps. However, it is also noted the existence a challenging context characterized by socioeconomic inequities. In general, the influence of public policy on the promotion of these programs is observed, as well as the need for a theoretical methodological support for the development of an integral management model, in which the technology component does not constitute a parallel item. Management of educational institutions is crucial to normalize experiences and provide references that can be integrated into environmental conditions.

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The notion of Information and Communication Technologies (ICT) as a relevant element within the innovation processes of organizations, including educational ones, is widely accepted (Cifuentes, 2016; 2016; Kozma, 2010). Likewise, the notion of ICT as an innovative element is reinforced by recent empirical studies from the Organization for Economic Co-operation and Development (OECD, 2012), pointing to a positive relationship between adoption and use of ICT and the economic performance of its member countries at micro and macro levels. In its report on innovation in the knowledge economy, the OECD (2004) points to ICT as a driver of innovation

along with three other major drivers: scientific knowledge, collaboration between user-makers and modular structures. Thus, the creation of user networks and the flow of shared knowledge are valued as articulators of innovations with the potential to break into the entire system and not to only be absorbed by their current practices.

In the education field, ICTs have been identified within public policies as elements of innovation with expectations of knowledge potentialization and democratization of education, producers of development with equity (Lugo & Brito, 2015; Lugo & Ithurburu, 2019; Represas, 2015). These expectations have risen ICT initiatives in almost all countries, with emphasis on the provision of infrastructure and improvement in access indicators. Nevertheless, results from ICT incorporation in education do not show the expected scope and effectiveness; suggesting that they have not revolutionized but reinforced existing teaching methods, curricula and educational goals (Torres, 2010; Watson, 2006). In other words, they have been assimilated by current systems without having generated the anticipated disruptive effect. Similarly, UNESCO (2011) points out that policies have the capacity to add value to the educational processes and system results; as long as they are considered a systemic change. In this systemic perspective, policies are capable of promoting innovations based on technology. Yet, innovations could occur throughout the system and still not change it, if their objectives, practices and structures remain unchanged.

Policy is defined by Nuñez Urbina et al. (2013) as the set of government provisions that guide a certain order within the educational setting, in order to achieve established goals of design, implementation or evaluation of proposals; within a political, social and cultural framework. Although this definition coincides with the habitual consideration made of policies as a strategic discourse which shares a broad vision of the context, to motivate people to change and coordinate efforts within the system, these can also be operational. Policies can derive into plans, programs or projects that provide mechanisms and resources with which to realize the generated vision (UNESCO, 2011).

Cifuentes (2016) considers that future research on ICT should consider the area of implementation (execution) of education policy as a key part of the analysis of contemporary educational policies in the Latin American context. Context is relevant to politics (Ball et al., 2012). This relationship can be established since, just as policies create context, this also precedes them. The context relevant to politics is understood to be comprised of location, history and population, material aspects and external pressures. For Latin America, the context is even more important while evaluating public policy implementation results, given the existing characteristics of socioeconomic inequality in the region.

In the analysis of the development and implementation of educational policies in ICT, subjects and their social, historical and cultural processes are also relevant; which are interrelated from prescription until execution of the government order (Nuñez Urbina et al., 2013). In the execution, we find the reinterpretation of policy that is carried out within the organizations to integrate it into the existing structure and processes. Thus, a methodological redesign in relation to the adoption of technology is necessary to integrate all the actors and generate permanent changes in the organization (Salinas, 2005).

An understanding of the integration of ICT in teaching-learning processes reveals that there is a close relationship with politics, under which the academic, administrative and organizational aspects are intertwined (Cifuentes & Valbuena, 2018). This internal management of educational institutions combines quality assurance systems and accountability practices of both academic and

administrative personnel including discourses of efficiency in the practice of public management. Strategic plans increase success in the integration of ICT in educational contexts (Cifuentes & Vanderlinde, 2015). Despite this, the influence of ICT management models in schools as part of the implementation of public education policies has not received enough attention and has been relegated from studies of innovation supported by technology in education. As a result, there is little systematized information about it (Cifuentes, 2016; Sunkel, Trucco, & Espejo, 2013).

Management can be defined from different perspectives. If observed from the organization actors' interactions, it can be understood as "the ability to articulate mental representations of the members of an organization" (Casassus, 2000, p. 4). In order to observe the implementation of public policies, we consider the ICT management in education from the paradigm of the mobilization of resources (material, human and social).

The objective of this work was to identify representative ICT integration programs in educational activities presented in recent decades in Latin America, as part of the interpretation and adaptation of public policies to the particular context. The aim is to emphasize the mechanisms established by the actors to assume the strategic planning of innovation from the day-to-day management of the school. To meet this objective, an exploratory study based on bibliographic techniques was proposed. The literature review methodology uses both public documents from official government sites and supranational organizations, as well as articles in scientific databases that account for regional experiences in the field and meet the criteria of thematic and temporal relevance. The present study addresses the following research questions:

1. What are the public policies and programs implemented for the adoption of ICT in education in Latin America in the last two decades?
2. How the implementation of those programs is perceived by the management practices?

Method

In order to meet the established research objective and answer the research questions, an exploratory study based on bibliographic techniques was developed. According to Chong (2007), a documentary research "is the methodical and formal process that facilitates and supports the agile and systematized access to the product of scientific research, reported in documentary sources". Its importance lies in that it "leads to the collection of information, systematically, analytically, synthetically and critically" (p. 187). Documents with the following characteristics were included in the review:

- Bibliographic database; including peer reviewed articles and books published in Spanish or English from year 2000 to date.
- Databases of international organizations for education and economic development: UNICEF, OECD, CEPAL and SITEAL.
- Electronic pages of government agencies; Colombia, Mexico & Argentina.

In the end, more than 70 articles from scientific journals, 4 databases and 3 government websites were analysed. For each coincidence, priority was given to the existence of an exposition of the policies that went beyond the discourse analysis to focus on the experiences and their results; preferably from the actors' vision and describing the nature of the programs as well as their impact.

Results

Countries in Latin America are part of a heterogeneous region, where great socioeconomic inequalities are yet present, despite most of them having a democratic process and a growing

economy in decades (Lugo & Brito, 2015). Regarding ICT, those inequities are reflected in both, access and use performance; and are the result from factors such as income level, social and educational status, geographic ubication and ethnicity (OECD, 2015). In a similar order of ideas, Lugo and Ithurburu (2019) consider that the challenges that the region must face in ICT policies rest, along with access, in the dimensions of digital literacy and inequality of the uses given to digital technologies by the population. The OECD notes a gap between the productive sensor and the formation on ICT provided by the higher education system (OECD, 2015).

According to the OECD, governments consider ICT to be an important platform for research and innovation in all sectors. Consequently, its main associated areas of interest are penetration of bandwidth, research and development in ICT, financing for innovative entrepreneurship, and diffusion of technology in business. Particularly with regard to ICT, the priorities during 2012 of the member countries of the OECD were ICT skills and employment, online government, as well as the security of information systems and networks (OECD, 2012).

Citing the report on "Telecommunications in Latin America", Lugo and Brito (2015) highlight the fact that the penetration of bandwidth in households during 2012 was 70.5% for Europe and 78.4% for the United States; while in Latin America it only reached 34.2%. Regarding mobile broadband penetration, this was 47% for the population of Europe and 20% for that of Latin America. For this reason the countries of the region have promoted connectivity plans, such as the Argentina Connected National Plan, the Imagine Chile 2013-2020 Digital Agenda, the Colombian Live Digital Plan 2010-2014, the Uruguay Digital Agenda, the National Digital Strategy for Mexico, the National Telecommunications Plan 2011-2015 CONATEL of Paraguay, the Development Plan of the Information Society in Peru The Digital Agenda 2.0, the National Plan of Telecommunications Development 2009-2014 in Costa Rica, among others.

Regarding other indicators of ICT infrastructure in the region such as the percentage of households with a computer and the percentage of households with Internet access, they are located in 2012 according to SITEAL data (2019) at 33.94% and 26.4% respectively. Uruguay is the country with the highest index of households with a computer and Internet access; while Nicaragua has the lowest indicators for the region as seen in Table 1. This in turn has led to programs to provide computer equipment for schools and the creation of community centers and public access points in several of the member countries.

Table 1

Percentage of Households with a Computer and Percentage of Households with Internet Access in Latin American Countries During 2012

	Percentage of households that owns a computer	Percentage of households with Internet access
Argentina	56	47.5
Bolivia	25.9	10
Brazil	46.3	40.2
Colombia	38.4	32.1
Costa Rica	48.96	47.3
Chile	53.69	40.9
Dominican Republic	19.7	13.65
Ecuador	32.21	22.5
El Salvador	19.6	11.8
Guatemala	19.15	9.3
Honduras	15.12	13.2
México	32	26
Nicaragua	9.93	7.4
Panama	38.3	30.5
Paraguay	24.29	25.1
Peru	28.5	20.2
Uruguay	63.7	48.4
Venezuela	39.2	29.3

Source: SITEAL

As previously mentioned, the digital divide also corresponds to income inequality. So, despite recent efforts, the quintile with the highest income also has greater access to a computer (41%) and the Internet (11%) compared to the poorest quintile access (4% and 1% respectively). If the gap is analyzed in terms of GDP percentage, the cost of access to broadband per inhabitant is 0.4% in the United States and 1.1% in Canada with much higher costs for Latin American countries (1.5% in Uruguay and 2% in Brazil to 22.8% in Nicaragua and 81.9% in Haiti) according to data reported by ITU for 2012 and cited by OECD (2015).

Still, schools in less developed countries, such as those in South America, face more barriers to the use of ICT in addition to the primary represented by accessibility. Some range from access to computers, lack of software, technical and administrative support, teacher training, internet access and, in some cases, even lack of electricity in some areas (Kozma, 2010). Hence, about 44% of developing countries have developed national plans for the growth of the ICT sector and another 20% are in the process of developing them. Although a large number of countries are reported with plans to accelerate infrastructure, more specifically the adoption of bandwidth, there is great diversity among them in terms of objectives and policies. Remarkable is also the fact that in many of the programs there is a lack of theoretical bases to carry out the evaluation of the effectiveness of such ICT policies (Prashant, Naveed, & Hamid, 2015).

Some of the ICT programs settled in Latin America as part of the strategic development initiatives are shown in Table 2. This list does not intend to be exhaustive, but to account for the diversity of existing proposals in the region and, in some cases, even within the same country.

Table 2

Strategic Programs in Latin America for the Incorporation of ICT in Education

Argentina	Educ.ar
	Programa Núcleos de Acceso al Conocimiento
Bolivia	Una computadora por docente
Brazil	Programa Nacional de Acesso ao Ensino Técnico e Emprego (Pronatec)
	Programa Nacional de Formacao Continuada em Tecnología Educacional (Integrated ProInfo)
Colombia	Educa Digital Colombia
	Programa de Formación de Educadores CREA-TIC: Inspirar, Crear y Diseñar Aprendizajes con TIC
Costa Rica	Plan Nacional de Tecnologías Móviles (PNTM), Tecno@prender
	Programa Nacional de Informática Educativa (PRONIE MEP-FOD)
Cuba	Jóven Club de Computación y Electrónica (JCCE)
Chile	Formación Docente para el Desarrollo de Competencias TIC
	Tecnología en el Currículum
Dominican	Agenda Digital
Republic	Programa Compumaestro 2.0
Ecuador	Agenda Educativa Digital
	Plan de Acceso Universal y Alistamiento Digital
El Salvador	Programa Creando Conocimiento
	Programa “Cerrando la brecha del conocimiento”
Guatemala	Estrategia para una Educación de Calidad para la Niñez y Juventud Guatemalteca
Honduras	Agenda Digital de Honduras
México	Estrategia Digital Nacional
	México Conectado
Nicaragua	Proyecto de Telecomunicaciones rurales
Panama	Aprende al Máxico
	Para, Piensa, Conéctate
Paraguay	Plan Director TIC
	Alfabetización Digital (Infocentros Comunitarios)
Peru	TIC para la educación pública
	Plan de Desarrollo de la Sociedad de la Información en el Perú la Agenda Digital 2.0
Uruguay	Uruguay Digital
	Plan Ceibal (Conectividad Educativa de Informática Básica para el Aprendizaje en Línea)
Venezuela	Plan Nacional de Alfabetización y Formación Tecnológica

Source: SITEAL (2019)

In the case of Peru (Balarín, 2013) there is a lack of systematized official information to allow the analysis of the impact of ICT policies in recent years. Likewise, the alternation between two trends is reported: centralizing the management of ICT policies and mainstreaming at all levels and spheres. In counterpart, Colombia is an example of the development of an ICT policy with a strategic vision; addressing elements such as infrastructure, human capital development, improvement of teaching practices with technology and management and production of digital educational resources. Thus, through its PlanEsTIC program, higher education institutions were encouraged to develop, implement and evaluate their own plan (Cifuentes, 2016; Galvis, 2014). In this flexible way, the characteristics of the context and the culture of the organization could be considered within its own strategy of technological appropriation and policy execution.

On the other hand, Argentina has recognized both the financing difficulties involved in the obsolescence of ICT, as well as the importance of linking the public and private sectors in these initiatives. Its Connect Equality Program aims to go beyond the provision of infrastructure, to reorganize the actions of institutions in the same field; recognizing the importance of communication policies in educational management (Vacchieri, 2013). In the same case is Costa Rica, where ICT projects are developed in conjunction with a non-profit organization promoted in 1987 by the Costa Rican government, the Omar Dengo Foundation. In this country, a comprehensive management model is reported, covering the operational framework, infrastructure, monitoring and evaluation (Muñoz et al., 2013).

In addition to Costa Rica, Uruguay is one of the few countries in the region that has an evaluation program for its social and technological inclusion plan (Plan Ceibal), which includes quantitative and qualitative approaches. However, this program has been repeatedly pointed out to the lack of articulation with the formal education system, being developed without the participation of educational authorities or teachers (Vaillant, 2013). This is a case in which political aspects have a strong influence on the development of programs. Therefore, the aforementioned need of recognize the relation between policies and implementation, and the relevance of management systems.

In Mexico, educational innovation programs are also strongly linked to changes in public administration and have a strong political component. In 2013, the National Digital Strategy was presented as an action plan with the objective of promoting the adoption of ICT and the incorporation of Mexico into the Knowledge Society. The plan's goal was to increase the level of digitization in Mexico, raising it from the last place obtained during 2011 among OECD members to the average index (Gobierno de la República, 2013). Current models in Mexico include computer labs, educational portals and digital content, the provision of computer equipment to classrooms and the emergence of the 1 to 1 approach (Díaz Barriga Arceo, 2013). Moreover, the creation of inter-institutional knowledge networks for the use of technology and the promotion of distance learning is pursued in higher education (Garzón Clemente, 2014).

Similarly, Ecuador has internal differences in terms of Internet access and computer systems likewise the rest of the countries in the region. In 2017, this country formulated the Digital Educational Agenda with the aim of strengthening education by incorporating innovative technologies and practices. It seeks to develop digital skills in students, strengthening pedagogical aspects and improving access in alliance with public associations (Loja, 2020).

Overall, from the aforementioned strategic programs it can be observed that, even though ICT employment for education and innovation has appeared on the Latin American political agenda, it

is not clear that they are accompanied by a theoretical support that strengthens its employment at classroom level and benefits its effective appropriation by the community members in which they seek to influence. The strategies used vary from connectivity improvement, equipment provision and teachers training to external participation proposals with financing purposes. However, there is no evidence of the development of an integrated management system in schools, one which includes the systematic information collection that allows its evaluation as well as a precise definition of evaluation criteria.

The development of successful ICT inclusion policies will depend on their ability to converge the efforts of the different stakeholders. Such collaboration is required during both stages, policy development and its implementation, while placing existing experiences within the context in which they take place. The proposal of Lugo et al. (2016, as cited in Lugo & Ithurburu, 2019) to analyze the factors that influence the design and implementation of these policies in education are the dimensions such as planning and management, infrastructure and connectivity, digital, and pedagogical culture.

Discussion

Literature shows that, although Latin American countries are formalizing strategic plans on ICT, most of them do not incorporate evaluation systems on their implementation (Cifuentes & Vanderlinde, 2015; Lugo & Ithurburu, 2019) and do not have a systematic data collection. This is considered one of their weakest points. These are characteristics that differentiate the region as well as the remarkable social and economic differences. However, it can be seen how innovation through ICT has opened its way in the regional political agenda and the existence of a gradual progress in the areas of infrastructure and access.

Although public ICT incorporation policies are issued by the State, it is important to incorporate the different sectors in their planning, implementation and evaluation. Alongside, existing problems and tensions among sectors should be addressed during this process (Lugo & Ithurburu, 2019).

As Casassus (2000) stated, there is a problem of divergence of objectives in the management from the scale perspective. Thus, politics is located at the macro level and deals with the economy from a pragmatic and neoliberal perspective; while the micro level is devoted to student learning, from pedagogy. The tensions originated are observable when the design of policies does not consider elements to articulate them. That is why considering the incorporation of ICT as regular part of educational management allows an association between technological innovation and the culture of the organization, an articulation that is yet lacking in the implementation of those policies. In this study, we found multiple existing regional initiatives and some of the difficulties they face from the dimensions of context, policy and theoretical foundation. It also presents the need to approach the phenomenon from a systemic position that combines the communication of the discourse within the organization with its substantive processes.

The existence of strategic areas within the planning and implementation of ICT public policies can be identified given the discussed characteristics of the geographical context as well as the existing challenges at the global level in terms of work and digitization. These areas primarily include the gaps in access and digital literacy. Additionally, educational systems and in particular higher education subsystems merit a rethinking of the nature of their traditional teaching model (OECD, 2015).

The efforts aimed to reduce gaps entail a revision of the financing systems, distribution projects and the integration of collaboration proposals from the public and private sectors. We have already

discussed how, although most of the region governments have ICT policies with such orientation, these still lack effective evaluation and monitoring mechanisms. Furthermore, implementation measures that develop a digital culture should add to the initial emphasis placed on access. Technological advances and digital inclusion in schools do not automatically constitute an improvement in educational practices but are required conditions to advance in the construction of pedagogical conditions for educational change (Lugo & Ithurburu, 2019).

On the other hand, reflection on ICTs in education is not limited to determining the implementation mechanisms addressed to reduce gaps. On the contrary, it is necessary to include the strategic role of the educational system in the development of the digital competences required both by the labor market and for the integration of the population in a digital culture. University and their functions are part of this reflection; not only joining the technological transformation but updating its relationship with society.

Conclusions and Implications

Results from the study provide a descriptive framework for the recent implementation of ICT educational public policy on several Latin American countries. It presents the relationship between strategies and management that have been developed in each particular case for the adoption of technological resources and their adaptation to the contextual characteristics. This review contributes both to the analytical reflection of the processes of adoption of innovations, and to establishing comparisons of the management models used in the educational field to interpret and execute public policy from a pre-existing organizational structure.

It has been observed that, besides the complex context, the policies implementation require flexibility to integrate local leadership and management strategies within an institutional level. It is not a novelty that teachers play a crucial role on the adoption of technology on education. But the program's results have also made evident that their mere willingness to use technology is insufficient to produce an effective adoption when there is a lack of a support structure, evaluable objectives and procedures that can be provided by an adequate management. Therefore, ICT adoption programs may benefit from the integration on the institution management practices, including formal and informal leadership.

Additionally, the lack of robust evaluation systems and the inference of politics diminishes the long-term goals for the region. The multiplicity of programs arises questions about their articulation and their capacity to introduce permanent changes into the system. However, we found a region with consistent evidence of a compromise to invest public resources aimed to innovate their educational practices and reduce the existing social gaps despite the complex conditions. The same conditions will prove to become even more challenging in coming years and thus in need of strategic actions.

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