Challenges in the creation and implementation of technology based on educational projects in the public education system of Bogotá – Colombia

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Abstract

The article presents the results of the first phase of a doctoral research project whose objective is to analyze the processes of monitoring, implementing and evaluating two programmes focused on teacher training, in the primary and secondary public education system of the city of Bogotá in Colombia, during the years 2020 and 2021. The programs are delivered by two government entities responsible for administering education services in Bogota: The District Education Secretariat and the Institute for the Development of Education and Pedagogy, and they are called: 1) Inspiring teachers' program. 2) Professional networks of teachers for educational innovation. This research focuses on the line of technological appropriation and seeks to generate knowledge to improve the monitoring processes and impact of ICT appropriation programmes in education. Proposal of different formulation: Sequential exploratory research was used to analyze the concept of the two programs. The paper presents the results of the first phase of content analysis: the qualitative analysis of the content of the program, as stated in the formulation documents. The results of the documentation phase emphasize on the identification of perspectives and conceptualizations on teacher training, professional networks, the adoption of technologies, educational innovation and its relation to the strategic plans of public education policy in Colombia.

Keywords: Technologies in education, teacher training, large scale educational programs, evaluative research, content analysis.

1. Introduction

The paper draws on an evaluative impact research aiming to analyze how the Institute for the Development of Education and Teaching (Instituto para el Desarrollo de la Educación y la Pedagogía), hereinafter referred to as IDEP, is carrying out a teaching and research project on the use of ICT in the system public education Bogota (primary school and secondary school), during the years 2020 – 2021. More specifically, it is considered the way the processes of monitoring, implementation and evaluation of results were performed. The research focus is part of a doctoral research thesis. The doctoral research project is an evaluative research process, situated in the years 2020 and 2021 on two IDEP programs: 1) Inspiring teaching program. 2) Professional networks of teachers for educational innovation. The main research question is: How do the monitoring, implementation and evaluation processes carry out by IDEP account for the ICT phenomenon in education in the primary and secondary public education system of the city of Bogotá? then, the focus of the research process is the phenomenon of ICT and followed, the critical examination of the relationship of this with innovation and pedagogical transformation.

In the present paper is presented the characteristics of the selected projects and the institutions managing them, with the aim of highlighting the main conceptualisations identified with regard to educational innovation and technological appropriation, which are in turn the categories of projects of the research project.

2. Context
2.1.Institutional contextualization.

To begin with, Secretary of Education of Bogotá (Secretaría de Educación de Bogotá) hereinafter called SED is a public and governmental institution which administers the provision of educational services at all educational levels in the city of Bogota, perform financial management and implements sectoral public policy programmes and guidelines established by the Ministry of National Education. IDEP is an entity created by SED in 1994, responsible for information management, knowledge production and educational research and generates teacher training programs and strategies for the appropriation of the objectives of public education policy (Concejo de Bogotá, 1994; IDEP, 2022)

It is important to clarify that Colombia is a country of political decentralization. The main entity of education at the national level is the Ministry of Education, which establishes public policy guidelines for the country every 10 years, but each region must create its own plan according to regional diagnoses. Each region has cities and rural areas with their own Secretariat and local plan with a duration of 5 years. Only Bogotá has an institute dedicated to the administration of programs and monitoring of sectoral policy. Consequently, all the actions and programs that are created in IDEP are based on the guidelines of the education sector plan and the diagnosis of the education system carried out by the SED. The action of IDEP is the

public education system of Bogota, which includes approximately 26,000 teachers in 422 schools, and serves approximately 870,000 students in elementary and secondary education. (IDEP, 2022)

The planning of work agendas for the education sector in Colombia is based on the construction of education plans by territorial levels, the strategic lines of local plans are derived from the national plan; and the diagnostics correspond to the population and geographical specificities of each territorial level.

The following tables show in a general way the location of the sectoral plan in the macro structure, then will focus only on the results of the diagnosis of the sectoral plan of the city of Bogota as regards teachers, technologies; and the strategic lines and indicators that are the basis of the programs to be analysed.

LEVEL	Implementation period
National	10 years
Departmental: Colombia has 33 regions composed of cities, provinces and rural areas.	10 years
Local: Each city has a local education plan based on diagnostics of the specific needs of each city.	5 years

Table 2: Levels of formulation of education plans in Colombia
Source: Own production

2.2. Contextualization of selected programs
2.2.1. Inspiring teaching program.

The program started in 2020, as a pilot training project aimed at teachers developing pedagogical projects that emerged during the period of confinement by covid-19. In 2021 it became the most important program of IDEP, because the process consisted in providing training workshops on pedagogical innovation and advice for each teacher to write a book chapter with a description and qualitative reflection on pedagogical projects, and presentation to university academic peers for feedback.

In the call for inspiring teaching program, participating teachers who have created and implemented pedagogical projects in their schools presented them. That the institutional pedagogical projects in the public education system in Bogota are organized on the basis of the general law of Colombian education (Ministerio de Educación Nacional, [MEN] 1994)

The schools, based on their autonomy, in spite of implementing the national curricular standards on specific areas, can design and implement their own pedagogical projects, according to the specific school context.

On the other hand, the political constitution of Colombia establishes the freedom of professors as a right from which teachers can guide the development of a pedagogical process; hence, each teacher is free to propose educational projects to intervene in social or educational problems that arise in their classes. In this perspective, the inspiring teaching program selects teachers who created pedagogical projects of pedagogical intervention mainly to address the challenges of hybrid schooling, during the Covid-19, and beyond. Result, most of the projects correspond to the creation of alternatives for specific needs that arise in educational institutions.

2.2.2. Professional networks of teachers for educational innovation

This project was created and executed by SED and IDEP for two purposes: a) To characterize the groups of teachers in the public education system of Bogotá who belong to collectives. b) Provide training and advice to promote pedagogical innovation, collaborative work and the writing and publication of collective processes. c) Provide financial support for the organization of events to promote the meeting of teachers' collectives.

Teachers' collectives are associations created by public sector teachers in the city of Bogota, not-for-profit organizations that have organized themselves to create alternatives around specific problems of elementary and secondary public education, or to create pedagogical projects of specific or interdisciplinary subjects.

The teachers setting up these groups voluntarily and without receiving any financial compensation, are teachers with a permanent contractual relationship with the SED. The conditions and guarantees of employment contracts allow them the freedom to create pedagogical proposals and implement them in the educational institutions to which they belong. These groups are established as solidarity between colleagues, with the desire for learning and proposing alternatives of those who make it (Gallo, et al., 2018; Martínez, 2008; Tamayo 2006).

Since 2012, the SED and IDEP have invited so-called collective groups to generate dialogues with the institutions to receive financial support and participate in diagnostic and characterization activities, to include the principles of the plan in the proposals for the education sector, with a view of innovation and pedagogical transformation. In particular, during the years 2020 and 2021 the coverage and benefits of this project were expanded, considering that with the situation of confinement by COVID increased the number of teachers and pedagogical projects that were linked to existing networks or there were created new groups. Another purpose of this project is the linking of teachers to the processes of the teacher program that inspire from the strategy of connecting proposals with related topics and collaborative work.

3. Methodology

The research process will be carried out through a mixed model, called Sequential Exploratory Design, in derivative modality, in which the collection and analysis of quantitative

data are expected to be built sequentially based on qualitative results (Cameron, 2009; Creswell, 2003).

This paper relates to the first phase of the project, which is qualitative, documentary and descriptive, because aimed at identifying the diagnosis and problems underlying the creation of strategies in IDEP programs, referring to the balance of diagnosis and conceptualization used in the formulation documents of the two selected programs, particularly theoretical and methodological references oriented towards innovation and pedagogical transformation of ICT-based projects in the years 2020 to 2021, with a view to the following questions and objectives:

Specifical objetives	Research questions
- **Identify the diagnosis and problems underlying the creation of strategies in the IDEP programs that are aimed at innovation and pedagogical transformation of ICT-based projects during the years 2020 to 2021.** - **Deduce theoretical and methodological references that support the specific actions of the IDEP programmes for innovation and educational transformation with ICT-based projects.**	- What are the problems identified in the diagnostics that support the creation of intervention strategies for innovation and educational transformation in teaching projects using ICTs? - How were the diagnoses that precede the creation of the inspiring teachers program prepared? - What systems and institutions intervene or are part of the formulation of the program? What are the identified needs for ICT and innovation in educational contexts? - Why are technologies, innovation and transformation main reference points in the formulation of the programs? - What are the theoretical postulates that support it?

In view of the aforementioned aspects, the processing steps are as follows:

3.1.Compilation of documents

The first step in compiling the documents was to examine the digital repositories to determine which public documents about the selected programs, subsequently, it became necessary to formally present the research to the SED and IDEP in order to request the formulation and implementation documents that are not public and contain information on programs diagnostic, formulation and design conceptual references.

Subsequently, virtual meetings were held with the working teams that lead the formulation and implementation of the programs from the SED and IDEP in which the research proposal was presented and requests were made for non-public diagnostic documents, formulation and conceptual references. The review of all compiled documents prioritized coding within the Atlas IT software, among those which specifically contain the aspects which are studied in Objectives 1 and 2 of the research, below are described the typologies found:

- Formulation documents, public and institutional policy references. (Three documents).
- Conceptual reference documents for the construction of program lines (Five documents).
- Reference books on teacher training and systematization (Two compilation books)
- Documents of balance of the processes implemented in the programs. (Twenty-nine documents).

3.2.Content analysis

The resulting documents will be processed through a content analysis, based on the measurement technique, the subsequent procedural sequence and systematic description of the content and logic based on the categories. (Canales, 2006; Páramo, 2011)

Coding of documents in Atlas TI software include the following aspects:
- Diagnostics that inform the formulation of programs.
- Map of actors, institutions, targets and indicators that are part of the selected programs.
- Main and secondary concepts in programme formulation.
- Identify relationships between research categories and other concepts.

4. Results

The most important aspect about the first phase of the project is an understanding of certain public policy concepts and the social context of Latin America that affect the perspectives about ICT appropriations and teacher training. That is why, in the first part of the results, the macro diagnostic references of the population of students and teachers of the Public Education System in the city of Bogotá are presented. Subsequently, emphasis is placed on the concepts of appropriation of technologies, innovation and all those that are used in the planning of teacher training.

However, the documents that were the focus of our content analysis are: Institute for the Development of Education and Pedagogy investment project (IDEP, 2020), Book a path to network recognition (Gallo, 2018), Education Sector Plan 2016 – 2020 (Alcaldía Mayor de Bogotá, [Alcaldía] 2017), Cartography of the networks (Lopez et al, 2017)

4.1. Population diagnosis in Bogotá's public education system – Colombia.

4.1.1. Diagnosis of student population based on the Bogota Sectoral Education Plan 2016 - 2020.

According with the diagnosis that grounded the two programs analysed (Alcaldía, 2015), difficulties regarding the access and retention of students in the educational system. They are caused by the following factors:

- Educational institutions in some localities of the city do not have adequate physical infrastructure and the demand for student quotas exceeds the supply, this situation is exacerbated in rural areas of Bogotá.
- Factors of the social conditions in the city of Bogotá that negatively affect students' involvement in teaching and learning processes: a) Identification of 471 hallucinogenic drug dispensing locations, which increases the rates of drug-using students. b) Students who have been assaulted in the streets surrounding the school for theft of belongings.
- Risk situations identified in the characterization of unsafe conditions affecting the student population of public-school students in the city of Bogotá: a) Situations of discrimination towards the following types of students: belonging to ethnic minorities in Colombia or belonging to a community displaced from rural areas of Colombia by armed conflict. b) Students involved in cases of physical aggression, internal and-or external to the school.
- The survey (Alcaldía, 2015) from which these results were generated is based on a sample of 125,180 secondary school students and included a sample of students from schools located in rural areas and at night. Information was collected based on six risk indicators: discrimination, bearing arms, aggression, drug incidence, intimidation.

 The performance of students in the public sector is lower than in the private sector:

- The tests knowing primary education in the language area show that the results of insufficient and minimal levels are at 50% of the population of students in public schools, which means: Difficulty in understanding texts, identification of main and secondary ideas of a text, difficulty making inferences
- In the area of mathematics there was also a lower performance in the public sector: Low capacity to perform simple mathematical operations, apply them in everyday contexts, identify patterns and build models.
- In terms of learning a second language, only 4.5% of 11 grade students in public schools reach levels B1 and B+ competence in English, in accordance with the Common European Framework reference CEFR.
- The statistical measurement of student evaluation is done from external evaluations, but there is no systematic information about evaluation actions created by teachers.
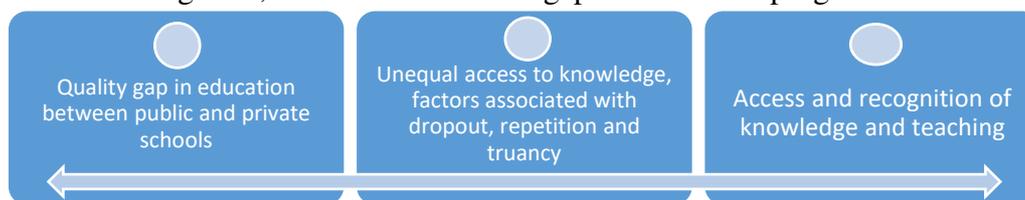
Considering the characteristics identified in the student population, the programs selected for the research seek that all actions constitute an intervention of problems of social inequality, for which the socio-political concept closing gaps is used, this concept refers to the

conditions of economic inequality and is recurrent in the socioeconomic diagnoses of the primary and secondary student population of the public sector education in Colombia.

The structural gap approach was coined by the Economic Commission for Latin America and the Caribbean to refer to obstacles to economic development affecting different social aspects of a country, mainly poverty conditions. Thus, it is defined that the level of per capita income cannot be equated with the level of economic and social development, for which it raises the premise: The hour of equality: gaps to be closed, paths to be opened, the focus on gaps focuses on a cooperation agenda to make visible the areas that require unavoidable attention from public policies, and as a guide to channel investment resources in Latin America. (CEPAL, 2012; Olmedo C., 2011)

IDEP's perspective on closing gaps with the implementation of programs
Figure 1, Work Lines to close gaps in the IDEP programs.

| Quality gap in education between public and private schools | Unequal access to knowledge, factors associated with dropout, repetition and truancy | Access and recognition of knowledge and teaching |

Source: Own creation based on the IDEP investment project (IDEP, 2020).

4.1.2. Diagnosis and historical references to teacher population characteristics.

The SED is the territorial entity in education with the largest personnel plant in Colombia. It has 34,906 teaching posts (32,942 teachers, 348 rectors, 30 directors, 1,562 coordinators and 24 supervisors), (Alcaldía, 2017). In the documents of formulation of the programs the central actor that must develop the pedagogical projects and specific actions for the populations is the teacher. The following is the diagnosis for teachers that is at the basis of the design of the selected programs:

The diagnoses of teachers included in the Education Sector Plan and in the selected programmes are qualitative. This perspective is assumed because since the 1980s, this area of the teachers' union has been a landmark in the history of education in Colombia, which is seen as having an impact to date on approaches to research and teach characterization in the public sector in Colombia.

As a historical contextualization, in 1982 the Colombian Federation of Educators - FECODE- Trade union organization of teachers belonging to the primary and secondary public education sector of Colombia was set up. It has a coverage of 270,000 affiliated teachers, out of the nearly 312,000 teachers across the country in the service of the state.

During the celebration of the annual Congress, launched the proposal called National pedagogical movement (Movimiento Pedagógico Nacional). The focus of the document was the creation of an education project aimed at the *popular classes*, concept referring to population groups whose socioeconomic conditions have deficiencies, limitations and

restrictions for economic access. Many of these people may belong to ethnic minorities. (Mejía, 2011; Peñuela y Rodriguez, 2006; Tamayo, 2006)

The foregoing, because public education in Colombia has always focused exclusively on the popular classes, and precisely in 1980s, the Colombian educational system was characterized as a private quality system for the elites, and another, low quality state without the resources for the popular classes. Then, the proposal of the pedagogical movement had the following characteristics:

   a) Improvement of the curriculum for popular social classes and provision of materials.
   b) The training of educators: Qualification and ongoing training to make it a builder of culture and pedagogical knowledge.
   c) Influence the decisions of public educational policy for the generation of reforms.

During the document review, four papers were identified that presented qualitative characteristics of teachers, that give basis to the Inspiring teachers' program and Professional networks of teachers for educational innovation, all mention the historical context of the pedagogical movement and the characterizations of the pedagogical expedition that have been carried out since the 90s.

Secondly, an identification of concepts and frequencies was made in the documents mentioned through the Atlas IT Software word list option and the exclusion of frequency words that are connectors or empty words, after each list, the 11 concepts that the software identifies as the highest frequency in the simultaneous processing of the four texts were selected, the following table shows the findings:

Figure 2: Concepts for increased use and frequency in documents with teacher characterization.
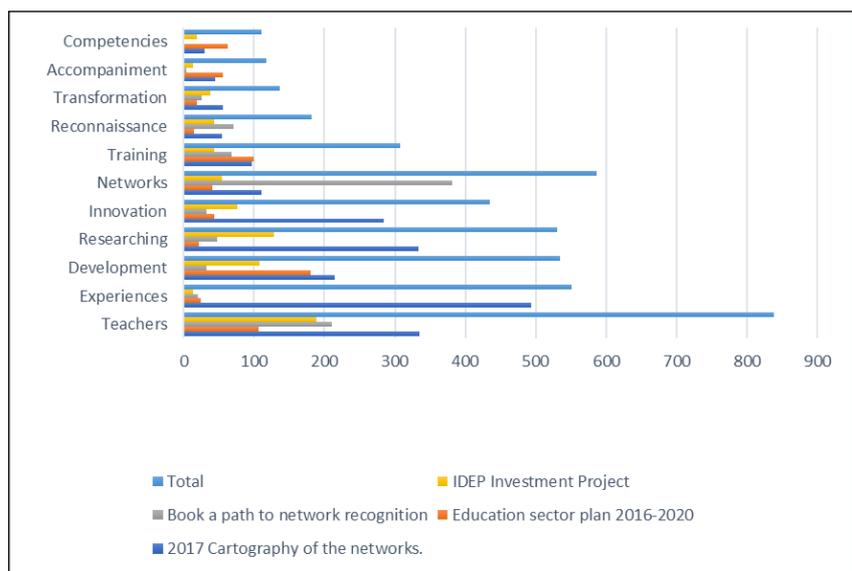
Source: Graphic created based on texts IDEP investment project (Instituto para el Desarrollo de la Educación y la pedagogia, 2020), Book a path to network recognition (Gallo, 2018), Education Sector Plan 2016 – 2020 (Alcaldía Mayor de Bogotá, 2017), Cartography of the networks (Lopez et al, 2017), frequency concepts identified in Atlas TI with respect to teacher characterizations.

About the concepts found in the table, the following section presents the conceptualization of accompaniment, educational innovation, appropriation of technologies and skills, since these were stated as the most relevant for the development of the selected programs.

4.2. The relevant concepts identify the literature review phase

4.2.1. Educational innovation

The concept of educational innovation is defined as planned and sustained processes which lead to identifiable improvements in the school context, according to Rivas (2.000), educational innovation is divided into two categories: The first is external innovation, which comes from existing procedures or content and is adopted in academic contexts. The second is the innovations that are generated in an educational establishment as a solution to an identified problem or need. Thus, the diversity of innovations can be understood on the basis of the component that is modified, the intensity of the changes, the manner in which changes are generated, the number of items changed on a system, and the number of people involved. It might be the whole school or only one group of teachers. There are two types of innovations: 1) Those that have a bearing on educational goals and objectives. 2) Those relating to the means as changes or objectives of the programme.

Subsequently, the selected programmes were formulated considering the aspects of educational innovation mentioned, added to the conceptualization of international entities. UNESCO's Latin American Guidelines are a key macro-benchmark, which are defined as changes that affect some structural aspect of education. In turn, it is a concept related to quality, inclusion, equality and equity in access to technologies. Therefore, it is expected that innovation will involve planning educational processes, institutional management, the practices of education professionals, so that it will generate strategies, methodologies, curricula and projects. (UNESCO, 2007, 2016).

Also, the guidelines generated by the Inter-American Development Bank (Banco Interamericano de Desarrollo) regarding public education policies related to innovation in Latin America, they suggest that innovation should have an impact on institutional communities and include an ongoing research component. Specific innovation programmes led by government institutions managing the education system, in order to generate the inclusion of diverse groups in the processes, should also serve as a guide for choosing digital and non-digital tools, as well as for projecting long-term educational innovation processes. (Arias, O., et al. 2021)

The axes of innovation in the sectoral plan and IDEP programmes: 1) Analysis of pedagogical and didactic problems. 2) Transformation of pedagogical practice. 3) Provide spaces in the city for the meeting of teachers in the processes of experimentation of pedagogical perspectives. 4) Promotion of human and professional development. 5) Appropriation of

strategies to create different forms of evaluation. 6) Generate recognition and incentives to raise awareness and disseminate innovative pedagogical experiences.

4.2.2. Appropriation of technologies

The conceptualisation of technology appropriation involves a socio-political component due to its relationship to public policy and the definitions of international institutions that seek to intervene in social conditions, which is why it is necessary to refer to two transverse components of the appropriation of technologies: 1) Digital literacy. 2) Competence development.

As far as digital culture is concerned, the assumptions emerged in the 1990s. An early author of this concept was the American Paul Gilster (1997), who established the following aspects as constitutive: 1) Learning about identifying information. 2) Integrating knowledge and communication. 3) Use of technologies as a tool rather than as a purpose.

Jose Luis Travieso and Jordi Planella (2008,) in the Latin American context, include the term social exclusion from a digital literacy perspective, pointing towards the economic and cultural deprivation. They argue that digital inclusion does not necessarily imply social inclusion, considering that knowledge of ICT tools can not automatically cover literacy skills on citizenship, collaborative work, ethnic minorities and that there are numerous people with difficulties of economic access to ICTs.

In the approaches of the last decade, the concept of ownership includes that technologies are elements that improve people's capabilities and human development; as a result, the approaches that have been implemented include telecommunications infrastructure, access to technology services and skills development for the use of ICT. (Salinas, 2014; Salinas & De Benito, 2020).

Salinas (2014) proposes to tackle the appropriation of technologies based on a vision of digital inclusion, which entails access to the benefits of digitalisation and also the ability of a social group to use them appropriately. He identifies the need for public policy to support digital inclusion in communities, promoting equality of opportunity and improving educational practices to this goal.

Concerning Colombia's proposal, the competencies aims developed through three levels of ownership: 1) Explorer level: is characterized by the approach of a body of knowledge that provides the opportunity to access states of greater conceptual development. 2) Integrative level: proposes the use of knowledge already adapted to the solution of problems in different contexts. 3) Innovative level: there is a greater emphasis on creative exercises, which go beyond acquired knowledge and create new possibilities for action or explanation. (MEN, 2022)

As reflected, all references emphasize the teacher's profile as a program developer and content adaptation, collaboration with fellow colleagues and creation of professional networks. As a complement, it is important to specify that in the Colombian context, a management

culture perspective has been positioned, where the formation of professional networks is seen as a transversal component, with respect to the levels of appropriation of ICTs.

4.2.3. Concepts of accompaniment and training teacher

Teacher training for the selected programmes is based on the accompanying concept, which refers to the consultation process for improving projects, pedagogical and management practices; therefore, the process involves characterizing project strengths and weaknesses and developing an accompanying plan with specific strategies. (Maros & Juniar, 2016; Oliva, 2017)

In the Latin American context, support perspectives are based on the challenges of contexts and social problems; therefore, teacher qualification refers to the teacher acquiring updated and new pedagogical perspectives to find needs and challenges based on the socio-economic problems of the student population. (Diloné, H. y González P., 2010)

As regards the structuring of the support provided by IDEP in the programmes listed above, it has an epistemological reference point for the recognition of teachers for their work and work from the complexity of the social realities experienced in the different territories of the city. Therefore, the pedagogical references of this perspective are based on the perspectives of critical pedagogy in Latin America. (Maros & Juniar, 2016)

In this sense, one of the components of the IDEP support processes for teachers is the systematization of teaching experiences, which is a descriptive and reflective writing procedure that seeks to make a critical and qualitative approach to pedagogical processes that can generate social changes.

In fact, systematization is a perspective that emerged in Latin America in the seventies from processes of literacy of the oppressed, interculturality, recognition of indigenous peoples, work with adults, social and community work, among others, framed within alternative education, popular inspired by the contributions of the Brazilian pedagogue Paulo Freire (Jara-Holliday, 2011).

Considering the characteristics of the student population serving the public educational system in Bogotá, IDEP seeks to provide support to teachers who develop educational projects that help solve social problems in the city of Bogotá. For this reason, systematization is an alternative of reflective evaluation.

5. Conclusions

This research project is intended to contribute to the consolidation of research processes for the evaluation of educational programmes oriented towards the implementation of technologies, therefore this article constitutes the first contribution to the identification of key concepts for constructing an investigative analysis model on the appropriation of technologies in educational settings, being the area of technological research in education, a constantly evolving area that has gone through various stages that have changed research problems,

methodology, the distinction between research with the media and on the media, the analysis of the interactions generated by the agents of the professor-student learning.

Certainly, one area that has disrupted educational policy theories and approaches at the international level is the health emergency situation that has occurred since 2020, which accelerated the use of technology in the educational context, its impact on transition and educational theories regarding the integration of technology in education, this includes knowledge exchange, collaborative learning and the production of new content.

As a result, the project should promote the appropriation of technologies between Latin America and the European Union, expanding conceptualizations and approaches to the following aspects that are related in international documents and policies on ICT ownership in educational contexts, these include the relationship between technology appropriation, digital culture and the information society.

Also, considering a research dialogue perspective is the possibility to promote research and the expansion of interconnections between research networks and academic communities in both regions. To strengthen the construction of knowledge that articulates technology, pedagogical models and curricular structures of educational institutions and their relationship to the implementation of public education policy.

In this first documentary and descriptive phase, certain aspects of the selected programmes are likely to highlight the regional relation and guidelines:

The relation between teachers and qualification in digital competencies and participatory approach of public education policies to technology ownership where teachers are expected to build research communities for policy understanding and participation to generate proposals that make curricular innovation programmes sustainable.

The management of administrative and institutional processes as priorities for the involvement of curricula in perspective of educational innovation under an institutionalized strategic plan to effectively influence the processes of technology training and ownership, because it requires a process of continuous monitoring, assessment and pedagogical and didactic reflection.

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