AUTHORITIES:

UNIVERSIDAD CENTRAL DEL ECUADOR

FACULTY OF LETTERS AND EDUCATION SCIENCES

Ph.D. Fernando Sempértegui

Rector

Dra. María Augusta Espín

Academic Vice Chancellor

Dra. María Mercedes Gavilánez

Research, Doctorate program and Innovation Vice Chancellor

MSc. Marco Pozo Zumárraga

Administrative Vice Chanceller

Ph.D. Guillermo Terán Acosta

Dean of the Faculty of Philosophy, Letters and Education Sciences

Ph.D. Juan Carlos Cobos Velasco

Vice Dean of the Faculty of Philosophy, Letters and Education Sciences

Zip code: Av. Universitaria, Quito 170129

E-mail: decanato.fil@uce.edu.ec

Phone number: (+593) 2506-658 ext. 111 o 22904-760

LAYOUT
MSc(c). Jorge Adrián Santamaría Muñoz. Universidad Central del Ecuador.
(jasantamaria@uce.edu.ec, web personal)

DESIGNER
Tnlgo. Iván Alejandro Miranda Madrid. Instituto Tecnológico Superior Cordillera, Ecuador
(iv1993.16@gmail.com)

DESIGNER COVER PAGE
Tnlgo. Iván Alejandro Miranda Madrid. Instituto Tecnológico Superior Cordillera, Ecuador
(iv1993.16@gmail.com)

TRANSLATOR
Ph.D. Adriana Beatríz Curiel Ávila. Universidad San Francisco de Quito. Ecuador
(arcuriela@asig.com.ec, https://www.usfq.edu.ec/Paginas/Inicio.aspx)
MSc. Diego Patricio Maldonado Miño. Universidad San Francisco de Quito. Ecuador
(dpmaldonado@asig.com.ec   https://usfq.edu.ec/paginas/inicio.aspx)

LAYOUT DESIGNER
MSc(c). Jorge Adrián Santamaría Muñoz. Universidad Central del Ecuador.
(jasantamaria@uce.edu.ec, web personal)

ASSISTENT
Lic. Silvia Calvachi. Universidad Central del Ecuador. Ecuador (sjcalvachi@uce.edu.ec)

OJS TECHNICAL SUPPORT
Ph.D. Juan Carlos Cobos. Universidad Central del Ecuador. Ecuador. (jccobosv@uce.edu.ec)
MSc(c). Jorge Adrián Santamaría Muñoz. Universidad Central del Ecuador.
(jasantamaria@uce.edu.ec, web personal)

EVALUATORS
Coordinador Ph.D. Guillermo Terán. Universidad Central del Ecuador. Ecuador
(grteran@uce.edu.ec)

Contact

Zip code: Av. Universitaria, Quito 170129

REVISTA CÁTEDRA **E-MAIL:** revista.catedra@uce.edu.ec

Editors-in-Chief: Sergio Luján-Mora y Verónica Simbaña-Gallardo

E-mail of editors: vpsimbanag@uce.edu.ec

Phone number: (+593) 2506-658 ext. 111 o 22904-760

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OBJECTIVE
To disseminate multidisciplinary scientific unpublished articles, elaborated under the parameters of the research methodology, written with academic rigor and based on the teaching practice.

TOPICS
The topics covered are the theoretical bases of the Education Sciences in its different specialties and levels of the educational system.

TARGET
The Revista Cétedra is directed to all the national and international researchers interested in publishing quality works that contribute to the improvement of the educational process. From its origins, the Revista Céetdra was published in printed format. It is currently published in electronic format, using virtual environments to align to the needs of the revista s users and editors.

MISSION
The Revista Cétdra, of Universidad Central del Ecuador, Faculty of Philosophy, Letters and Education Sciences, disseminates scientific articles on diverse areas related to the Education Sciences, supported in the methodology of educational research and community service.

VISION
To be promoters in the publication of high quality scientific articles oriented by a research and from different areas of knowledge to constitute in the most prestigious reference in the comprehension and improvement of the educative process.

FOCUS AND SCOPE: Revista Cátedra has as theoretical bases the Education Sciences in its different specialties and levels of the educational system. It disseminates scientific-academic articles written under research parameters. It is open to national and international writers interested in contributing significantly to the solution of current educational problems.

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EDITORIAL

Cátedra Magazine is pleased to present volume three, number two in the electronic version. The subject matter developed has its theoretical bases in the Educational Sciences in their different specialties and educational levels; this is how some relevant aspects are presented, such as Education-Public Policy, Initial Education, Education-Informatics, Education-Mathematics and Education-Research

The contents presented in this new issue are characterised by the fact that they have been prepared under parameters typical of research methodology. Moreover, they are built with academic rigor and based on teaching practice.

The issue consists of eight approved articles:

The first article, entitled *Inclusion and territoriality in the general levelling for the exam Ser Bachiller en el Ecuador*, by Oswaldo Haro-Jácome, Héctor Simbaña-Cabrera and Juan Aguilar-Paoquiza. The manuscript describes the inclusion: by gender, ethnicity, disability; and by provincial, cantonal and institutional territory of high school students participating in the General Leveling Course, second process of 2019, executed by the Ministry of Higher Education, Science, Technology and Innovation (SENESCYT), in agreement with the Public Company UCE. The treaty specifies the rights of young people who are trained to take the Ser Bachiller exam prior to entering university. It was found that high school dropouts and those who fail slightly outperform those promoted. In terms of gender inclusion, the promotion of women is much higher than that of men; by ethnicity, mestizos far outperform participation and approval. No cases of disabled high school graduates were reported during the course. In terms of territory, high school graduates from the coastal region outnumber those from other provinces and cantons, while, in terms of institutions, public educational establishments, run by the State, have greater participation.

The second article, entitled *The labor perception of the graduates of the intercultural university model in Mexico, the case of the UNICH and the UIEM*, by Zuzana Erdösová and Rafael Juárez-Toledo. The manuscript analyzes the dilemma between the interculturalist discourse reflected in the entry and exit profiles that support this type of higher education, and the prevailing situation for its graduates as they seek to enter the labor market. The initial question referred to in order to locate the problem is: what happens once the intercultural university education is concluded? Although the perception of intercultural education is positive for its authorities and graduates, a profound incomprehension or ignorance of the intercultural proposal and of the role that intercultural graduates must play in society, specifically in the labor market, has been identified. Graduates must face problems related to discrimination, low salary levels and the lack of efficient opportunities for personal development. Through a qualitative process, applied in the different actors, the perception of the performance of intercultural graduates has been obtained for two geographical and socio-cultural contexts: The Intercultural University of the State of Mexico and the Intercultural University of Chiapas.

The third article entitled *Construction of child sexuality in the family environment*, by Martha Quirola-Larrea and Cecilia Jaramillo-Jaramillo. The objective of the manuscript was to verify if through a formative process the ways in which parents seek formation and information

about sexuality for their children change. A programme on child sexuality was implemented with legal representatives from a Comprehensive Early Childhood Development Centre in the city of Quito. This research was quasi-experimental. Entry and exit surveys were applied to the direct and indirect actors of the programme, divided into experimental and control groups. The final conclusion is that the programme had a significant impact on changing the perspective of parents. It includes the practices of various sex education possibilities with their children. Similarly, there is the possibility of educating parents in the school and community environments to improve the quality of life and family management.

The fourth article entitled *Registration of academic titles through an application based on Blockchain and Smart Contracts*, by Luis Rosero-Correa, Mario Morales-Morales and Santiago Morales-Cardoso. The manuscript analyzes the proposal of feasibility of an application based on Blockchain technology and Smart Contracts to reproduce the process of assigning academic titles to students without the need of a central entity, third parties and bureaucratic processes while taking advantage of the characteristics of these technologies such as transparency, security and immutability. Thus, two complementary intelligent contracts were developed, taking advantage of the characteristics that currently exist to create structures that represent real-life objects and functions that manage these structures as parameters. These contracts were executed in a virtualized environment in which a chain of Ethereum blocks was simulated with the Truffle toolkit. The smart contracts were evaluated by entering test data and with these records stored in the block chain the process of assigning academic degrees to students through a function within the main smart contract was executed. To validate that the process ran correctly, the block chain was queried and it was verified that the title assignment records were generated and stored in the block chain successfully. In this way it was possible to conclude that the proposed model based on blockchain technology and intelligent contracts is feasible.

The fifth article entitled *Analysis of the implementation of the educational services portal: EducarEcuado*, by Santiago Vinueza-Vinueza, Joshua Pozo-Caicedo, Anthony Pacheco-Gallegos and Richard Arequipa-Caisaluisa. The manuscript presents the analysis of the implementation of the EducarEcuador educational platform in the national education system, as well as the importance of the use of virtual platforms at present. The research sought to evaluate the rate of incorporation of the virtual platform in the country's educational institutions. Among the results, it is perceived that the implementation and management of the platform's tools has been more successful in the fiscal jurisdiction. The lack of technological infrastructure in the country is perceived. Consequently, this absence limits the management of the educational platform. However, it does not limit only the users but also strongly limits the implementation of the platform.

The sixth article entitled *Didactic innovation for the understanding of the concept of vacuum in hydrostatics*, by Franklin Molina-Jiménez and Lucia Goyes-Chulde. The manuscript describes a proposal of didactic innovation aimed at improving the understanding of the concept of vacuum, which is studied in the hydrostatic branch of physics and constitutes one of the most complex and important topics to understand, since it is involved in many activities that the human being develops, from the fundamental process of breathing, to that of generating numerous scientific and industrial advances. The research was developed under a quantitative, quasi-experimental, inductive process in which thirty-three students of the Pedagogy of Experimental Sciences, Mathematics and Physics Career participated. They worked in two moments, in which it was established that the average percentage of understanding of the subject analyzed in the pre-test and post-test increased from 44.70% to 79.55%. This allowed to intuit that the use of the didactic innovation proposal, based on the application of the didactic technique questions answers and of the strategy of laboratory

investigation led to improve the understanding of the concept of vacuum, besides verifying how this influences the daily work.

The seventh article entitled *Perspectives on Scientific Production in Ecuadorian Universities*, by Jorge Balladares-Burgos, Ángela García-Naranjo and Cristina Granda-Villamar. The manuscript arises from the need to know the situation of scientific production in national and international indexes of Ecuadorian universities from 2003 to 2017. These indexes reveal the disadvantage of universities at the national and international level. Ecuadorian Higher Education Institutions (HEI) are in lower positions at the Ibero-American (IBE) and Latin American and Caribbean (LAC) levels than the number of publications they have produced. Likewise, determine the influence of the 2008 Higher Education reform on the scientific production of HEI. The methodology used in this research is of an inductive-deductive nature, supported by bibliographical review and hermeneutics. It is concluded that in the period 2003-2013 the San Francisco de Quito University published more scientific content at the national level while in 2013-2017 it was the University of the Armed Forces. Also, it is evident that the universities increased their research production at the IBE, LAC and national levels. With these data, we seek to show the effects of the implementation of public policies that regulate scientific production in HEIs.

The eighth article entitled *Analysis of Ecuador's scientific production through the Web of Science platform*, by Elking Araujo-Bilmonte, Liceth Huertas-Tulcanaza and Kenny Párraga-Stead. The manuscript was born from the disadvantage found in Ecuador's scientific production with respect to other Latin American countries. The objective of this research is to reflect on the importance of scientific production for the social, educational and scientific development of the country. The methodology used in this research is inductive-deductive and is supported by bibliographical research using the hermeneutic method. The results obtained in scientific production of the Web of Science platform for the periods 2006 - 2008 and 2015 - 2020 in Latin America are presented. These periods are taken as a reference to contrast the records of scientific production prior to the university reform in Ecuador in 2008 with the current ones. Among the results, an increase in Ecuador's scientific production in the last period is determined. Ecuador is in position 7 of the 20 countries analyzed. It is concluded that Ecuador shows a growth in scientific production as the other countries. However, there is still a significant difference with respect to: Brazil, Mexico, Argentina, Chile and Colombia.

Cátedra Magazine thanks all the authors and reviewers of the articles that have made the publication of this issue possible. It extends an invitation to the national and international academic community to present their research work related to the Educational Sciences in their different specialities and educational levels.

Directors/Chief Editors

Inclusión y territorialidad en la nivelación general para el examen Ser Bachiller en el Ecuador

Inclusion and territoriality in the general leveling for the Ser Bachiller exam in Ecuador

Oswaldo Haro-Jácome

Universidad Central del Ecuador, Quito, Ecuador

oharo@uce.edu.ec

https://orcid.org/0000-0001-6387-9591

Héctor Simbaña-Cabrera

Universidad Central del Ecuador, Quito, Ecuador

hasimbana@uce.edu.ec

https://orcid.org/0000-0002-9802-5470

Juan Aguilar-Paoquiza

Escuela Superior Politécnica del Chimborazo

juan.aguilar@espoch.edu.ec

https://orcid.org/0000-0001-8882-5717

Resumen

El artículo describe la inclusión: por género, etnia, discapacidad; y por territorialidad provincial, cantonal e institucional de bachilleres participantes en el Curso de Nivelación General, segundo proceso del año 2019, ejecutado por la Secretaría de Educación Superior, Ciencia, Tecnología e Innovación (SENESCYT), en convenio con la Empresa Pública UCE. El tratado puntualiza la situación de derechos de la juventud que se capacita para rendir el

examen Ser Bachiller. La investigación se fundamenta en el enfoque cuantitativo no experimental, los hechos se abordan desde la perspectiva transversal y su profundidad es exploratoria-descriptiva. Los instrumentos de campo fueron: la encuesta en línea aplicada mediante la plataforma de la Universidad Central del Ecuador, aplicada a 7.665 bachilleres, de los cuales contestaron 4.073 que se constituyó en la muestra casual no probabilística. Las notas para observar participación-aprobación se extrajeron de las aulas virtuales por dominio de la plataforma. Se descubrió que bachilleres desertores y reprobados superan levemente a aquellos promocionados. En inclusión por género la promoción de mujeres es muy superior a varones y otros géneros; por etnias los mestizos superan ampliamente la participación y aprobación. No se reportaron casos de bachilleres con discapacidad en el curso. En territorialidad los bachilleres de la región litoral superan al resto de provincias y cantones de otras regiones. Mientras que por instituciones los planteles educativos públicos, regentados por el Estado, tienen mayor participación.

Palabras clave

Bachilleres, educación superior, inclusión, nivelación académica, territorialidad.

Abstract

The article describes inclusion: by gender, ethnicity, disability; and by provincial, cantonal and institutional territoriality of high school graduates participating in the General Leveling Course, second process of the year 2019, executed by the Ministry of Higher Education, Science, Technology and Innovation (SENESCYT), in agreement with the Public Company UCE. The treaty clarifies the situation of youth rights that are trained to take the Ser Bachiller exam (Be Bachelor). The research is based on the non-experimental quantitative approach, the facts are approached from the transectional perspective and its depth is exploratory-descriptive. The field instruments were: the online survey applied through the http://www.filosofia-uce.com/ platform of the Central University of Ecuador, applied to 7,665 high school students, of which 4,073 answered that it was the casual sample not probabilistic. The notes to observe participation-approval were extracted from the virtual classrooms by domain of the platform. It was discovered that defending and failed high school graduates slightly exceed those promoted. In gender inclusion, the promotion of women is far superior to men and other genders; by ethnic groups the mestizos (half blood) widely exceed the participation and approval. No cases of high school graduates with disabilities were reported in the course. In territoriality, high school graduates from the coastal region surpass the rest of the provinces and cantons of other regions. While by institutions the public educational establishments, run by the State, have greater participation.

Keywords

High school graduates, higher education, inclusion, academic leveling, territoriality.

1. Introduction

The policies of application to the Public Higher Education Institutions of Ecuador (IES) such as: universities, polytechnics and institutes were implemented as a pilot project in 2011 and officially and mandatory in 2012. The rules governing entry to the IES are: The Constitution 2008, Organic Law on Higher Education (LOES) and National System of Leveling and Admission (SNNA). The modality of entry through examinations is already nine years old

and has been very controversial, due to factors such as: rights, inclusion, territoriality, interculturality, even the type of examination.

The entry into public IES through examination approval, in its implementation went through two rather differentiated stages. In a first stage the National Examination for Higher Education (ENES) from 2012 and then being a Bachelor since 2017.

One of the most controversial aspects is the inclusive or meritocratic conception of IES membership. Its guiding principles planned by SENESCYT, consistent in Article 3) of the Regulation of the National Leveling and Admission System (SNNA) 2019, provides that they are the: "(...) equality of opportunity, and freedom of choice of career or careers and institution" (SENESCYT [2019], p 2).

The principles of the SNNA are easily disputed, since for example the meritocracy according to the statement of Cociña (2013), a "(...) meritocratic society – which corresponds to the utopian view of a market society – is a society that, at least in principle, does not reduce – much less eliminate – the current levels of inequality or misery" (p. 4). Admission to Ecuador's higher education system, given the very disparate conditions in the distribution of wealth, has brought countless difficulties in accessing university and career of interest of each high school, on similar occasions.

The data for field analysis were extracted from the survey of associated factors of the General Leveling Course, May-July 2019, provided by the UCE Public Company to Ecuadorian high schools, in agreement with SENESCYT. This course was facilitated by the Linkage Unit with the Society of the Faculty of Philosophy, Letters and Educational Sciences.

The purpose of the study is to analyze the inclusion and territoriality factors in the participation-approval of high school students who attended the General Leveling process for the Ser Bachiller (Be Bachelor) exam. The period corresponds to the second process, May-July 2019, according to the annual planning of the Undersecretariat for Leveling (SENESCYT-Public Enterprise UCE, 2019).

The questions that it intends to investigate, in the light of the state of the question and the empirical data, are:

1. -How does the training for the Ser Bachiller exam offered by the State to Ecuadorian high schools identify and address differences in inclusion and territoriality, in order to reduce the exclusion of higher education, especially to young people in rural situations and periphery of cities? (Educational Inclusion, 2016), and
2. - How is territorial equity evident: geographical, social and individual (Aceves, 1997, p. 286), of baccalaureates in the virtual leveling offered by SENESCYT, for the examination of entry to Ecuadorian public IES.

Finally, the treaty seeks to approximate an explanation of the overall leveling contribution of SENESCYT to the wide gap in the Ser Bachiller test score. Above all, including peoples and nationalities, as a way to democratize entry to the Higher Education System, with competitive scores that facilitates access to IES and careers of their vocation and personal interest.

The article has the following structure: first, the introduction with basic conceptual approximations, the objective, research questions. Second, the definitions of study variables: general leveling, inclusion, territoriality. Thirdly, the methodological process. Subsequently the results and dusion, and conclusion are recorded.

1.1   General leveling

The general leveling of high schools who are interested in applying to Ecuadorian public IES, as well as achieving a national or international scholarship for higher education, is regulated in several legal bodies. The rules that determine the leveling are basically the Constitution 2008, and more specifically the Organic Law on Higher Education (LOES), which under Article 81 provides for "a National System of Leveling and Admission, which guarantees equal opportunities in access, permanence, mobility and in the egress" (National Polytechnic School[2019, p. 1).

There are two levels of income to higher education regulated by Article 3 of the LOES Regulation expressing Leveling. It will take into account heterogeneity in the formation of high school and/or the characteristics of university careers" (SNNA [2011], 10).

First, the general leveling, which is free training under the responsibility of SENESCYT (formerly by the IES), is carried out to high schoolers who did not achieve a place in one or more re-orders of the Ser Baciller exam. This course is held twice a year; one for the coastal and island regions and one for the Sierra and Amazonian regions. It is precisely in the general leveling, first period of the year 2019 that the field study was carried out.

Secondly, the career leveling that is an induction course for high schools who already passed the Ser Bachiller, applied and were accepted to a University Career. This training is operated by UNESCO knowledge areas and is in charge of IES.

1.2   Educative inclusion

Inclusion is an essential factor for any service delivery process in Ecuador, especially in the assessment of knowledge for access to rights purposes. Educational inclusion is recognized as a principle by the Organic Law on Intercultural Education which in Article 11, literal v. states:

> Equity and inclusion ensure that all people have access, permanence and completion in the Education System. It guarantees equal opportunities for communities, peoples, nationalities and groups with special educational needs and develops an ethic of inclusion with affirmative action measures and a school culture included in theory and practice on the basis of equity, eradicating all forms of discrimination" (Asamblea Nacional, 2011, p. 11).

The principle of inclusion encloses the whole of Ecuadorian society. Any high school who is interested in entering the IES, must have opportunity without discrimination for its origin, social, cultural and worse conditions for physical differences, ways of learning or health, that is, there are no prerequisites for exercising rights. Leiva (2013) argues that: "While inclusive education pays special attention to vulnerable and marginalized groups, its purpose is to fully realize the potential of every individual and not just that of specific groups" (p. 7).

The principle of meritocracy declared by the SNNA regulations is completely contradictory to social inclusion and particularly to education, because while the former puts the whole of society in the same educational condition, which is a chimera in an extremely heterogeneous society between socio-economic sectors; the second clearly recognizes the differences between the social sectors, but advocates permanent processes that recognize these differences, for the equitable benefit of all, in this case, in university admission.

1.3 Territoriality

The territorial category is currently widely used in social planning systems, especially in intervention projects to improve the living conditions of Community sectors. Fundamentally, it focuses on human beings and geographical space, as a dialectical whole that interacts in society with cultural, economic and even environmental effects on rurality. Farrell, Trillón, and Soto (1999) testify that, "the territorial approach induces the integration of public and private institutionality linked to rural development and the empowerment of participating local actors, fundamental aspects for the appropriation of the process; it also has a multiplier effect on other territories" (p. 10).

Another widespread concept states that: "The territorial approach to rural development means a change of perspective: from the sectoral to the multisectoral, promoting multidimensional analysis (economic, political, social and environmental elements, among others)" (Villalobos, 2015, p.s/p). It is precisely that in this geographical space, essentially human and harmonious where life happens, these multiform relationships and forms of organization-action-collaboration happen, so that society can survive and become time.

In analyzing in the variable territoriality to the general leveling, "the territory in this perspective must be considered beyond its dimension of dominance, integrated into a cultural and social conception, in addition to the administrative and management that has traditionally prevailed" (García and Muñoz, 1999, p. 181). The territoriality approach is a multidimensional factor that is present in the attention to the right of entry to Ecuadorian IES, beyond the purely geographical.

1.4 Inclusion and territoriality in the general levelling

The educational and territorial inclusion in the general leveling provided by SENESCYT, although important institutional measures have been taken lately, is still a long way from welcoming high schoolers in optimal conditions, i.e. with policies of effective IES access. On inclusion in higher education, particularly in general leveling, Pérez-Castro (2019) argues that:

> The expansion of educational opportunities for all those groups in vulnerable situations, who have been excluded from the school system (…) for reasons of social inequality (poverty, rurality, gender, ethnicity and disability); institutional causes (action plans, supply conditions, institutional strategies, resources, among others); or by subjective personal factors (beliefs, values and attitudes) (p. 149).

The principles of: meritocracy, equity and equal opportunities that guide the examination of income to higher education in Ecuador, both in the ENES and the Ser Bachiller, contradict the inclusion, because they universalize the same examination and its consequences for all. While inclusion involves differentiated processes, to address the particularities and deficits of many high schools, through differentiated tests, contextualization of the examination and affirmative action.

To address inclusion and territoriality as the human rights of high schools, Haro (2018) recommends that it be acted by "a strong institutional relationship between the Ministry of Education and SENESCYT to design and implement clear policies in the educational transition from high schoolers to university, recognizing the cultural, historical and socio-economic aspects of Ecuadorian society" (p. 298). The public policy of university application involves the participation of all state entities related to the law of youth, a process that is still in caumder.

The process of transitioning from high school to college is itself complex, as teens are overcoming a stage of personal crisis. Unfortunately young people do not have professional guidance in the school and above all their educational process, in practice, is very differentiated between the urban and rural, as well as between the centrality and the periphery of the city. Socio-economic conditions are mostly poverty in families. The above aspects have been permanently denying access to higher education.

2.Metodology

The study was developed based on the principles of the quantitative methodological paradigm, a non-experimental design. The approach to the phenomenon was cross-sectional and the depth of analysis was exploratory-descriptive as it is a new phenomenon in the Ecuadorian context. The statistical treatment was carried out with the application of the Excel program to organize the data, then it was submitted to the SPSS package for the analysis of variables.

The data was extracted from the survey of associated factors applied at the beginning of the course and from the approval statistics of the general leveling, virtual modality, hosted on the UCE platform, http://www.filosofia-uce.com/, by the Directorate of Information and Communication Technologies (DTIC), between the months of May and June 2019. The survey was applied to high school graduates as a requirement for their enrollment in May, while the approval statistics were obtained from the database in June. Information processing was a mandatory component of the terms of reference (TDR) with SENECSYT. The notes to observe promotion were taken from the virtual classrooms of the five domains hosted on the platform.

The study population consisted of 7,665 high school graduates, previously reported by the SENESCYT Sub-secretariat for Leveling. The effective sample that provided data for the empirical analysis was 4,073 high school graduates, who effectively participated in the leveling. The sampling technique was convenient, the same as according to Otzen and Manterola (2017), it is applied due to "(…) the convenient accessibility and proximity of the subjects for the researcher" (p. 30).

The criterion of sample representativeness is relative because; On the one hand, the sample exceeds 50% of the population, which allows the results to be generalized to the target population, but a limiting factor is that the sample selection was not random.

3.   Results and discussion

Table 1 summarizes the tuition, movement and promotion of bachelors in the General Leveling Course executed by the Faculty of Philosophy (FFLCE) of the Central University of Ecuador (ECU). The 4,073 high schools that accessed the platform and are participants in the course throughout the country, are constituted in 100% of effective beneficiaries, is constituted in the study sample. Of this great total; 2,184 young people, corresponding to 53.62% did not complete their evaluations on the virtual platform, after having already made contributions and evaluations, therefore they are categorized as withdrawn and exceed half of beneficiaries. In Garcia's view (2007), the "causes of abandonment (…) of an online educational offer (are) the course materials (…), little time (…) for the realization of the task, the technological conditions (...) and communications with the tutor as a facilitator and guiding element" (p. 12). The course is completed by 1,889 high schools, corresponding to 46.38%, less than half of those retired high schools.

Virtual Modality	High School		Movement Enrollment			Final Promotion		
	Reported by SENESCYT to the ECU	Enrollment UCE	Don't access Platform	Access Platform		Retired	Reprobated	Approved
Starting totals	7.665	7.665	3.592	4.073		2.184	433	1.456
Percentage of progress		100%	46.9%	53.1%				
Percentage of promotion (final)				100%		53.62%	10%	35.75%

Table 1. Enrollment, movement and promotion of high school degrees in the course

Figure 1 systematizes the access of baccalaureates to the platform of the ECU, where of 7,665 high schools effectively enrolled, interact in virtual classrooms 4,073. Firstly it describes the evolution of your participation in the course, from tuition to promotion, where 3,592 (46.9%) young people did not ratify their enrolment on the leveling platform of the Central University of Ecuador. Consequently, 4,073 high schoolers benefited from effective training, corresponding to 53.1% of the total of enrollees, is a higher amount than those who did not enroll.
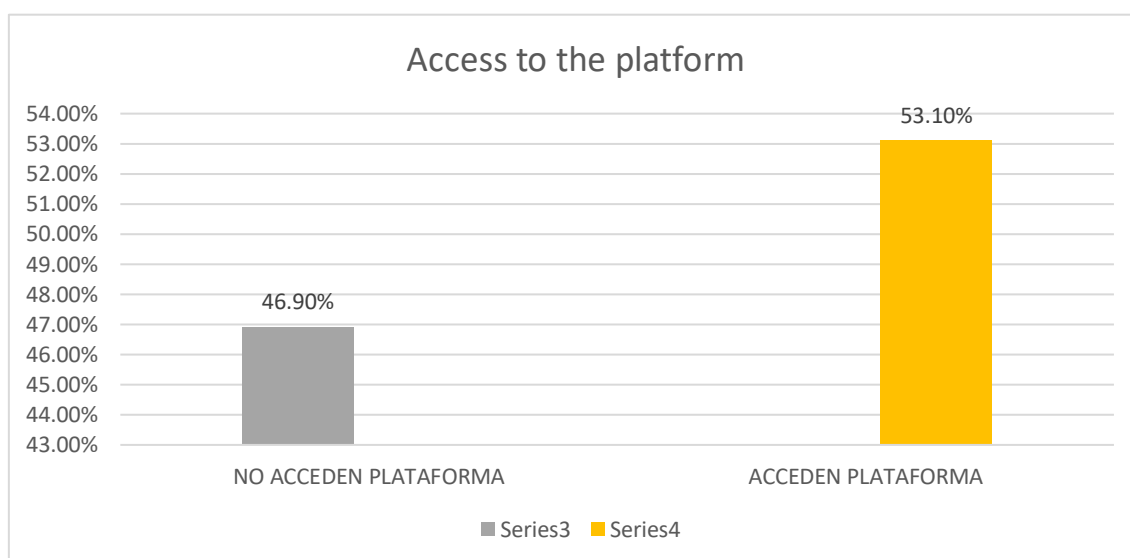
Figure 1. Percentage of platform access

Figure 2 illustrates the course approvals, with 1 456 bachelors corresponding to 35.75% exceeding 70% in their domain and attendance assessments, consequently they approve the course, it is the most relevant data. The negative is that they fail 433 high schools, corresponding to 10% of participants.

To calculate approvals, scores of five domain curricular activities per week were considered, for 10 weeks, with a total of 150 activities evaluated. In addition, interaction in the virtual classroom was observed for a minimum of 70% of planned activities in the domains. Virtual classrooms were enabled for 24 hours per day for 7 weekly days for partial domain activities.

About those high schools who signed up for the SENESCYT platform, but then retired. This group took the quota without first knowing the methodology of the course (virtual and online mode) and working hours. Once they entered the platform, they opted for their voluntary retirement, with no record of learning activities. A decisive aspect that leads to the measurement of withdrawal responds to the "easy" offers in the market, of face-to-face or semi-presencial courses that "guarantee" the application to the careers that are interested.

They also express distrust in the processes implemented by SENESCYT, because in this course, at the last minute the start dates were changed to a period very close to the Ser Bachiller exam. This circumstance did not favor with enough time for its preparation, because it was only 36 days from Monday to Sunday with an average of 7 hours a day of almost exclusive dedication to its training, which is commonly done with a maximum time of 4 hours a day, in about 63 days from Monday to Friday, in about 12 weeks , with rest intervals.

Another reason why several high schools retired responds to the lack of technological infrastructure in different parts of the country. Likewise, several high schools live and work in rural sectors which limits the development of activities on a daily basis, as programmed on the platform. The meeting relates to the report that: "36.0% of households nationwide have access to the internet (...). In the urban area, 63.8% of the population has used the internet, compared to 38.0% of the rural area" (INEC, 2016, p. 7 and 14).Finally, there is an under-analyzed aspect, but that is a reality in young people between the ages of 18 and 25, in this age range there are cases of those who wish to enter higher education institutions, but they live a marked mobility, which requires unexpected relinquishing their goals and aspirations for professionalization. For they move to other cities, even abroad, they change housing sectors because of work or the need for work or because they form a family and acquire other responsibilities
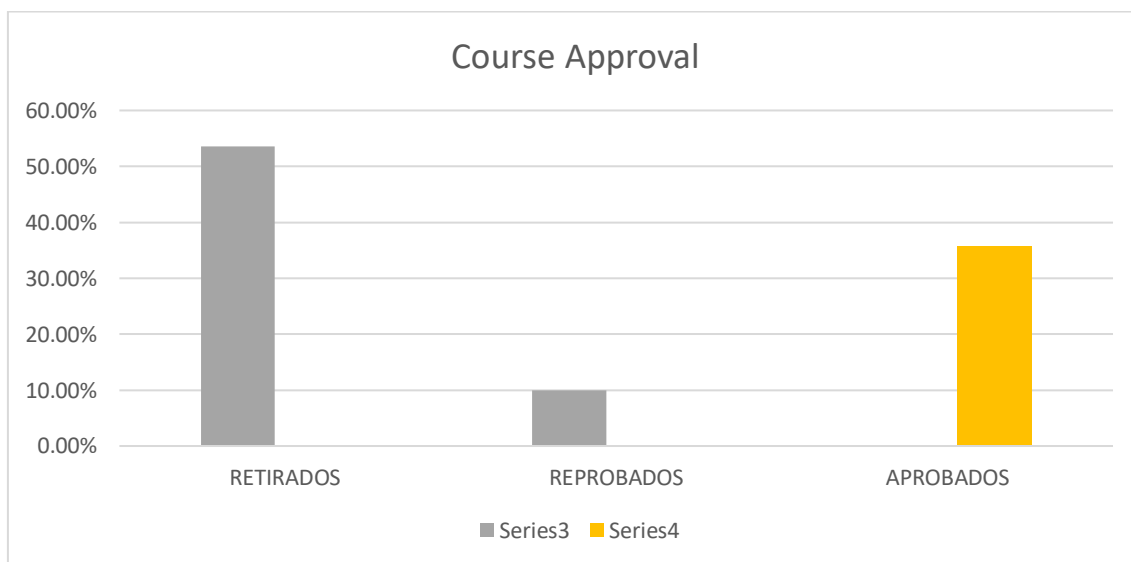
Figure 2. Course approval

Table 2 systematizes indicators of effective baccalaureate participation in the leveling course in the gender category, on which 4 073 participating high schoolers are analyzed. Of the total indicated are valid data for the analysis 2 096 baccalaureates (51.5%), while 1 977

(48.5%) are lost data from high schoolers who did not answer the survey on their gender identity.

Approvals, by gender, show that it is the most successful women in the course, with a total of 786 female high schools (69.1%) of the total approvals. Males are only 347 high school 30.5% and 9 young, one (0.4%) who identify their gender as others, and would be neither male nor female. The trend of highest approval of women is given by the generic composition of the baccalaureates participating in the course which is 4 073 (100%) of which 1 405 (34.5%) identify themselves as women, compared to 682 (16.7%) 9 (0.2%), giving 51.5% of the total. The unveiling is corroborated by the claim that: "women (...) at the time of evaluations or exams they come more than men to support friends, teachers, or family members when they have doubts in study topics, they are more aware of the teaching-learning process than men" (Sepulveda, and others [2011], 3).

Gender	Approved	Disapproved	Retired	Total
Femenine	786	178	441	1405
	69.1%	65.2%	64.4%	67.0%
Masculine	347	93	242	682
	30.5%	34.1%	35.3%	32.5%
Others	5	2	2	9
	0.4%	0.7%	0.3%	0.4%
Total	1138	273	685	2096
	100.0%	100.0%	100.0%	100.0%

Table 2. Participation of high school students in the course, by gender

Table 3 analyses the composition of graduates approved by ethnicities, firstly it is found that the Mestizo (half Blood) population is the one with the greatest participation in the different indicators described in the course, because they approve 1 294 (89.3%) beneficiary high schoolers. Secondly, the montubios (rural coastal people) with 58 people (4.0%), which, together with other indicators such as the origin by provinces and schools, explains that the largest population of high schools participating in the course come from the Ecuadorian coastal region.

Then, but far away, the auto-determined population is located as white, followed by indigenous, Afro-descendants, mulattos and others, with very low percentages, which add up give 7% of participants, which is statistically very little significant. The result shows and at the same time allows "(...) note that there are differences in ethnic self-identification averages, where indigenous and Afro-Ecuadorian groups maintain lower averages than those that self-identify as mixed/white" (Revalo-Gross [2018], 132).

Ethnicity	Approved	Disapproved	Retired	Total
Afro-descendant	24	11	72	105
	1.6%	2.6%	3.3%	2.7%

White	37	16	59	112
	2.6%	3.7%	2.8%	2.8%
Indigenous	19	2	27	48
	1.3%	0.5%	1.3%	1.2%
Mestizos	1294	363	1827	3484
	89.3%	84.6%	86.1%	87.1%
Montubio	58	28	96	182
	4.0%	6.5%	4.5%	4.6%
Mulatto	15	8	29	52
	1.0%	1.9%	1.4%	1.3%
Other	2	1	14	17
	0.1%	0.2%	0.7%	0.4%
Total	1449	429	2122	4000
	100.0%	100.0%	100.0%	100.0%

Table 3: Participation by Ethnic Identity

The composition of approved participants (Table 4), when categorized by disability, who said they did not have a disability, but approve the course are 1 446 (99.3%) almost all beneficiaries. While, those who expressed a disability: "hearing, physical, intellectual, language, psychosocial and visual" (National Directorate of Disabilities (DND), 2019, p. 3), and approved, do not exceed 1% of high schoolers. The data is less than the percentage of disabilities that in Ecuador 2 019 is 2.74%, dividing among the national population, which according to the National Institute of Statistics and Census (INEC) is 17 379.713 inhabitants (INEC, 2019), with the figure of 475.747 people with disabilities registered with the National Council for EqualIty of Disabilities.

Disability	Approved	Disapproved	Retired	Total
Physical	5	2	3	10
	0.3%	0.5%	0.1%	0.2%
None	1446	429	2168	4043
	99.3%	99.1%	99.3%	99.3%
Psychic	1	1	1	3
	0.1%	0.2%	0.0%	0.1%
Other	4	1	12	17
	0.3%	0.2%	0.5%	0.4%
Total	1456	433	2184	4073
	100.0%	100.0%	100.0%	100.0%

Table 4: Disability Participation

Table 5 examines the participation of high schoolers by province. The statistic of tuition and most significant participation of baccalaureates in the course, by categorizing the 23 provinces that have presence, highlights that Guayas is the highest represented 1 453 (36.6%), followed by Manabí with 721 (18.16%) third, Pichincha with 569 (14.33%), fourth, El Oro with 379 (9.5%) and in fifth place Los Ríos with 199 (5%).

The participatory feature of high schools in the five most represented provinces; in the first

instance it can be attributed to the population formation of young people of income to higher education. Another causal factor may be connectivity coverage and increased dissemination by SENESCYT in certain 18 provinces. The level of approval of the course, when categorizing by provinces reveals statistical behavior other than the enrolment rate.

The four best performing jurisdictions are: Tungurahua 15, Imbabura 29, Loja 44 and Azuay 14, although their participation is very low. While, in the five provinces with the highest participation, approximately one in three enrolled high schools approves leveling. This empirical analysis coincides with (García & Muñoz, 1999).

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Province	Approved	Disapproved	Retired	Total
Azuay	14	2	21	37
Bolívar	6	4	9	19
Cañar	4	1	6	11
Carchi	5	0	4	9
Chimborazo	9	0	10	19
Cotopaxi	3	1	15	19
El Oro	148	41	190	379
Esmeraldas	16	4	31	51
Galápagos	1	0	2	3
Guayas	463	147	843	1453
Imbabura	29	5	28	62
Loja	44	14	44	102
Los Ríos	74	25	100	199
Manabí	286	93	342	721
Napo	1	0	4	5
Orellana	0	0	1	1
Pastaza	0	0	3	3
Pichincha	209	68	292	569
Santa Elena	48	10	81	139
Santo Domingo de los Tsáchilas	42	8	77	127
Sucumbíos	1	0	5	6
Tungurahua	15	2	13	30
Zamora Chinchipe	2	1	3	6
Total	1420	426	2125	3971

Table 5: Participation of high school students by province

Table 6 summarizes the enrollment and participation of high schoolers by cantons. Priority is given for the analysis of 44 cantons, where there is evidence of participation of at least 10 high schools in the leveling, out of 147 beneficiary cantons. The first relevant aspect of territoriality is that the 34 cantons with the highest participation in the course are from the

Littoral Region, 10 from the Sierra Region and none from the Amazon or Galapagos. The order of participation of baccalaureates correlates with the population composition by regions of Ecuador, however, there is an superiority of baccalaureates of coastal cantons.

The five cantons with the highest tuition fee, in descending order are: Guayaquil with 1 215 baccalaureates, double that Quito with 518, then Machala with 214, then Portoviejo with 127 and at the end Santo Domingo de los Tsáchilas with 114 baccalaureates. Guayaquil participates in the leveling, with a third of high schoolers from all over the country, and more than double Quito, is the largest beneficiary.

The approval rate per canton, according to the statistical analysis revealed, that of the 44 prioritized cantons approve approximately one in three high schools, i.e. 1136 (35%), while they fail 336 (10.35%), and defect 1,774 (53.73%) very high figure. The baseline data arises from 3,246 bachelors (100%) enrolled in the cantons with the most presence of baccalaureates. The 726 un-analyzed high schools correspond to 103 cantons, whose presence in the leveling does not exceed 9 subjects enrolled.

Canton	Approved	Disapproved	Retired	Total
24 de Mayo	6	2	3	11
Ambato	10	2	11	23
Arenillas	5	2	8	15
Buena Fe	6	0	5	11
Cayambe	4	0	6	10
Chone	11	0	14	25
Cuenca	9	1	12	22
Daule	8	3	20	31
DM. Quito	190	64	264	518
Durán	21	13	49	83
El Carmen	12	1	10	23
El Empalme	3	2	7	12
El Guabo	5	2	18	25
Esmeraldas	10	3	21	34
Guayaquil	396	114	705	1215
Huaquillas	2	1	14	17
Ibarra	19	4	21	44
Jipijapa	12	1	22	35
La Concordia	4	0	9	13
La Libertad	21	5	41	67
La Troncal	3	1	6	10
Loja	23	13	27	63
Machala	100	23	91	214
Mejía	4	0	7	11
Milagro	9	4	20	33
Montecristi	19	10	26	55
Naranjito	3	1	6	10
Otavalo	6	0	4	10
Pasaje	15	5	32	52
Pedernales	2	1	11	14
Piñas	2	2	7	11
Portoviejo	46	18	63	127
Quevedo	26	8	40	74
Riobamba	9	0	9	18
Rocafuerte	10	4	6	20
Rumiñahui	8	3	12	23

Salinas	8	2	11	21
Santa Ana	7	2	6	15
Santa Elena	19	3	29	51
Santa Rosa	15	4	12	31
Santo Domingo	38	8	68	114
Sucre	5	1	8	14
Valencia	2	2	6	10
Vinces	3	1	7	11
Total	1136	336	1774	3246
No analizados				726
Matriculados				3972

Table 6. Enrollment and participation of high schoolers by cantons

Table 7 contains the bachelor's enrollment data by type of school of origin. In this respect, 1 568 (74.49%) high schools are public campuses, 363 (17.24%) municipal campuses, 154 (7.32%) are from private campuses and just 20 (0.95%) of fisco-missionary origin (public-private financing).

The composition of approved and unapproved beneficiaries, in relation to the types of school of origin of the baccalaureate, 845 (73.9%) high schoolers are of public origin, most of them. A major group of 197 (17.2%) young people are from private campuses in second place; 90 (7,9%) high school graduates are of fisco-missionary origin in third place, and; only 10 are municipally funded educational units, for the total approved of 1 143 (100%).

	Approved	Reprobed	Retired	Total
Fisco missionary	91	19	44	154
Municipal	10	3	7	20
Private	197	53	113	363
Public	845	199	524	1568
Total	1143	274	688	2105

Table 7. Enrollment and approval by school

El Table 8 condenses the overall averages of the assessment notes applied by domain. The evaluations have tasks, duties and exercises that the bachelors responded through questionnaires applied in the virtual classrooms, whose notes are hosted on the UCE platform.

The averages of the scores achieved by the high schools on the platform are about 15 points per week for 10 weeks total 150. The scores were weighted to 1000 points, to analogate the Ser Bachiller test score.

When analyzing the averages of the high schools that pass the course, the highest corresponds to abstract domain with 905.39/1,000 points, and the lowest to social domain with 812,12/1,000. The overall average of those approved in all domains is 868.55/1,000 points, with which the beneficiary high schoolers ratified their grades in the Ser Bachiller exam, consequently they have options to apply for public university career.

 The highest overall average over 1,000 points is observed in linguistic domain with 588/1,000 and the lowest mathematical domain with 493/1.000. In general, the average

domains considering approved, failed and withdrawn is 550/1.000 points which is a regular overall result, as it does not exceed the standard minimum score of 600 points.

The evaluation was developed as the last stage of the curriculum process, to observe the behavior of high schoolers on cognitive knowledge, skills, skills and abilities for the effective resolution of the Ser Bachiller exam. The virtual instruments used were: exercises, duties, tasks, simulations, as well as participation in interaction forums and participation in virtual conferences. A valuable indicator of evaluation was the interactive participation of high schools in virtual classrooms, because this looked at the degree of concern and commitment to their own preparation for the exam, beyond the target score, (Martínez, 2015).

The grade data achieved by classroom and domain served to assess the progress of work scores and progress weekly. With this permanent diagnosis, those high schools that were needed could be reinforced, while encouraging those with the best scores.

In the end it can be extrapolated that the results of the evaluations, despite the online modality, were quite significant, since 3 out of five high schools, 62% of them satisfactorily exceed the minimum 70% for approval, as an average of all evaluations and participation.

Domain	General Average/15	General Average /1000	Average approved /150	Average approved/1000
Abstract	86.28	575	135.81	905.39
Scientífic	86.39	576	135.10	900.68
Lingüístic	88.16	588	133.84	892.24
Matemathic	73.88	493	135.13	900.88
Social	77.65	518	121.82	812.12
Total	82.47	550	651.41	868.55

Table 8. Average assessments by domain summary

4. Conclusions

The main discoveries that are achieved in the study, which respond to the proposed research questions, are as follows:

The rate of graduates removed from the course is slightly higher than permanent participants. Participation-desertion percentages border 50% of the total. Among the main causal factors for dropout are: distrust with variations in the planning processes of the course by SENESCYT and poor technological and communicative infrastructure in the peripheral sectors of cities and especially rural ones.

When observing promotion of participating high schools of the general leveling course, the percentage of graduates that pass is much higher. Contrary to the percentage of those who fail is very low, but also representative, because it involves affecting the public investment of the State, and at the same time less access to the right of entry to IES, spatially from marginalized sectors.

The inclusion by gender in the leveling course shows that the highest percentage of participation and approval is for women, who more than double men and other genders. The survey did not identify genders that are identified exhaustively, but only in the other

category, but in a non-significant percentage. However, the lost data is almost similar to the valid data.

The inclusion by ethnicity, expresses that there is a percentage of participation and approval of the very high course in the group that defines itself as half-breed. The other constant ethnicities in the survey do not exceed one tenth of the total and include in order the second, then white, Afro-descendant indigenous people. The explanation of the montubios in the second place is because the greatest participation was of coastal high schools.

In disability inclusion, the data shows that high school without any disabilities participate and approve the course in almost the total percentage. While high schoolers with a disability their participation is almost nil. This phenomenon may be due to the mode of virtual and online training that does not meet special educational needs, which implies that subsequent processes serve this sector.

The inclusion by territoriality, in terms of the participation of baccalaureates by provinces, indicates that there is mostly a share of the coasters. In the highest approval group consists of four, also of the coastal region, only one of the mountains and none of the east. Instead, the approval of the course by provinces has four of the mountains in the first places, although its presence is minimal, which explains to some extent, the heterogeneity in educational quality and state care in the national context.

In terms of the participation of baccalaureates by cantons, the course involves 147, more than half of the 209 cantons distributed in the 23 provinces, since Morona Santiago had no presence. The largest number of cantons are from the coast, which is also related to the number of cantons among five of the highest participation are coastal, this finding correlates with national demographics. Participation has a supremacy of coastal provinces and cantons in the course. In the percentage approval by cantons, it was found that a third of high schools approve of cuso, one tenth and half defect. It is clear that territorial inclusion is relative, therefore, not all cantons and provinces participate on an equal basis and population percentages.

In inclusion by territoriality of educational institutions, it is manifested that two fifths of participating high schools are from public campuses (fiscal and municipal) and a tenth of individuals, as the most representative. Approvals vary, as three-quarters are from official (fiscal) campuses first, after individuals the two-fifths second, finally a tenth approves of fisco-missionary campuses. Young people most in need of Ser Baccalaureate exam training are from state schools, compared to individuals and funerals.

The average grades achieved in the approval of the course reflect that the final average score of the domains treated, in the case of ratification in the Ser Bachiller exam, will provide options for high schoolers to pass and apply for university degrees, with some ease. Whenever the beneficiary high schoolers also consider the recommendations of the Vocational and Professional Orientation (OVP) discussed in the course.

Course approval notes may be due to very short and intensive academic management time, with which high school was trained. Only 36 days worked, Monday to Sunday. An approximate time of seven hours per day of participation in virtual classroom, without days of rest and recovery.

Acknowledgement

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Authors

OSWALDO HARO-JÁCOME PhD. in Educational Research obtained at the University of Alicante-Spain; Master in Education; PhD. in Socio-Educational Research; Degree in Philosophy and Socio-Economic Sciences; Professor of Normalization.

Professor of History and Social Sciences at the Central University of Ecuador; former Director of the Higher Institute of University Extension; Director of the Plurilingual Career; former Professor at the University of the Armed Forces ESPE; former Professor at the

Sebastián de Benalcázar Municipal School and former Vice-Chancellor of the Eugenio Espejo Municipal Educational Unit.

HECTOR SIMBAÑA-CABRERA PhD. in Educational Research obtained at the University of Alicante-Spain; Master's Degree in University Teaching and Educational Administration; Degree in Educational Sciences. Specialization in Biology and Chemistry.

Professor at the Universidad Central del Ecuador, currently in the History and Social Sciences Pedagogy Career at the Universidad Central del Ecuador; Ex-Dean of the Faculty of Philosophy, Letters and Education Sciences; Ex-Director of the University Extension Department; Coordinator of the Pre-professional Internships at the Universidad Central del Ecuador; Member of the technical team of the General Coordination of Linking with Society at the UCE.

JUAN AGUILAR-POAQUIZA Doctor in Business Management from Universidad Mayor Nacional de San Marcos Lima-Peru, Business Engineer and Master in Finance.

Professor and Director of Society Relations at the Escuela Superior Politécnica de Chimborazo. Teaching experience since 2001 in the financial area and trainer of knowledge in the areas of Investment Portfolio and Capital Market. In the private sector, marketing manager of the Association of Grains and Grasses of Ecuador.

La percepción laboral de los egresados del modelo de la universidad intercultural en México, el caso de la UNICH y la UIEM

Occupational perception of the alumni of the Intercultural University model in Mexico, situation at the UNICH and the UIEM

Zuzana Erdösová

Universidad Autónoma del Estado de México, México

zerdosova@uaemex.mx

https://orcid.org/0000-0001-7924-7599

Rafael Juárez-Toledo

Universidad Autónoma del Estado de México, México

rjuarezt@uaemex.mx

https://orcid.org/0000-0003-3667-5125

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Resumen

Los licenciados interculturales son jóvenes procedentes de variados ámbitos socioculturales que se forman en el marco del modelo educativo llamado universidad intercultural, gestionado por la Secretaría de Educación Pública de México. En este trabajo se analiza la disyuntiva existente entre el discurso interculturalista plasmado en los perfiles de ingreso y egreso que soportan a la educación superior de este tipo, y la situación imperante para sus egresados toda vez que buscan insertarse en el mercado laboral. El cuestionamiento inicial al que se hace referencia para ubicar el problema es: ¿qué sucede una vez concluida la formación universitaria intercultural? Aunque la percepción sobre la educación intercultural es positiva para sus autoridades y egresados, se ha identificado una

profunda incomprensión o desconocimiento de la propuesta intercultural y del papel que los licenciados interculturales deben desempeñar en la sociedad, específicamente en el mercado de trabajo. Los egresados deben enfrentar problemas relacionados con la discriminación, los bajos niveles salariales y la falta de eficientes oportunidades de desarrollo personal. Mediante un proceso cualitativo, aplicado en los diferentes actores, se ha obtenido la percepción que se tiene sobre el desempeño de los egresados interculturales para dos contextos geográficos y socioculturales: la Universidad Intercultural del Estado de México y la Universidad Intercultural de Chiapas.

Palabras clave

Educación intercultural, egresado intercultural, mercado laboral, Universidad intercultural, UNICH, UIEM

Abstract

The intercultural bachelor is a term that refers to the young people from diverse sociocultural environments who took their degree in the framework of the recently founded educational model called Intercultural University, administered by the Mexican Ministry of Education. In this paper we analyze the uneasy position of intercultural discourse incorporated in the admission and graduation profiles, which give support to superior education, and the real situation in the labor market. The initial question, and key issue, is: what happens after the completion of the intercultural university education? The perception about of this Intercultural discourse is positive from authorities and students, but the situation outside the Intercultural Universities (above all in the labor market) which is marked by a deep miscomprehension or ignorance of given of the role that the intercultural bachelors should carry in the society. They have many problems as discrimination, low salary levels and inefficient programs of individual development. Through a qualitative process we obtain the perception from several actors about of the role of the intercultural bachelors. The research was carried out in two geographical and sociocultural contexts, the states of México: Intercultural University of State of Mexico and Intercultural University of Chiapas.

Keywords

Intercultural university, intercultural education, intercultural bachelor, labor market, UNICH, UIEM

1. Introduction

The structural changes that Mexico has undergone, which reflect the constant constitutional reforms, with ways to consolidate openness, privatization and deregulation, have caused economic and social pressure in local contexts. It is not hidden that for certain groups of the population, work performance is marginalised and precarious, as is the case with the indigenous population. In this regard, ethnic groups have had to participate in strong migratory waves (Cárdenas, 2014, Granados and Quezada, 2018) or have had to adjust their lifestyles within their own localities with ways of raising their levels of competitiveness and thus obtaining the economic resources for subsistence. Whether in the urban or rural context, the indigenous population has the highest rates of marginalization, poverty and exclusion in the country, as shown in various official documents and reports (Coneval, 2018a; CDI, 2018; INEGI, 2018; INEGI 2020).

Specifically, in Mexico, the educational gaps that place the population of native peoples in strong disadvantage are clearly perceived. According to data presented by the INPI (2010 and 2017), the average schooling for Mexico in 2005 was 8.8 years, but the indigenous population was below this indicator at 7.1 years. With data projected for 2015, it can be seen that the schooling panorama has not changed and that at all levels of formal education (except primary) it is the indigenous population that is least favoured. For example, the indigenous population in the group without any kind of education stood at 16.6 per cent (the national average was 6 per cent); at the level of primary education, the indigenous population had 18.2 per cent coverage (the national average was 15 per cent), but as progress is made at these levels, the problem is intensifying. Thus, at the secondary level, the indigenous population had access to 20.5 per cent (the national average was 23.7 per cent); and at the upper secondary level (high school) and above, the level of incorporation was 21.7 per cent for the indigenous population (the national average was 40.7 per cent).

Against this background, various public bodies have structured various educational programmes to serve as a channel for balancing inequalities among the Mexican population, particularly for the population representing indigenous peoples.

> One of the challenges in the design of the new educational model and of public action as a whole is to promote better results for all students and, at the same time, to close the educational gaps that have historically prevailed between different school sectors. This dual task, however, requires adherence to the principle of equity in order for education to foster social equality (INEE, 2017a, p. 7).

These programmes have adjusted their proposals according to the education system in question, although most of them assume this population as a special attention group, or in a vulnerable condition, to which attention is generally of a welfare type. For example, the executive document on education policy of the National Institute for Educational Evaluation (INEE, 2017b) refers to 29 programmes that are linked to basic indigenous education, whose justification is based on the right to education and as compensation for the historical debt owed to indigenous peoples.

> The above, together with the significant heterogeneity and social and economic vulnerability of this population, make it necessary to build affirmative actions aimed at reversing the gaps on the basis of inclusive, cross-cutting policies that respect the particularities of indigenous children, to end a long history of discrimination, racism and exclusion (INEE, 2017a, p. 2).

With regard to higher education, intercultural university education emerged in Mexico with the discursive intention of promoting the inclusion of indigenous populations in the spheres of national development. At the same time, it was possible to create a more just and equitable environment, not only in access to higher education, but also to create a type of professional with the capacity to mediate between their communities of origin and the environment. However, the features and conceptual elements with which it was integrated, which can be perceived in the vision, mission and entry and exit profiles, could be considered not in accordance with reality. Vázquez-Parra, J. and Campos-Rivas, C. (2016) highlight the fact that:

> highlight the fact that, although in recent decades there has been an increase in public programmes to balance the educational and labour position of the indigenous population, in practice this population has to deal with the structural problems of unemployment, together with vices and discriminatory practices in the selection of posts and the allocation of salaries (p. 830)

This idea shows that intercultural education has been addressing one side of the problem for indigenous populations, by locating a number of universities in strategic locations to achieve greater access and expand educational coverage. But what happens to the graduates once they have completed their intercultural university education? In addition to being interesting, it has been necessary to approach intercultural educational institutions in order to observe and document the problems that recent generations of graduates are facing. Since there are no programs at the moment for their incorporation into the labor field in a direct and advantageous manner, there is an incongruence between the training profile and the subsequent lack of jobs. Thus, this group of professionals must compete with others who were trained in other university options in a labor market that does not know them.

Thus, the main questions that were raised to follow up the research, the results of which are presented here, are the following: with respect to the educational model of the intercultural university, has it been able to take shape in a solid formation of graduates "of another type" who consequently act in society according to intercultural values? How many graduates have really succeeded in establishing themselves in professional areas that are in tune with their intercultural formation, how probable it is that the former students (especially those who declare an intercultural vocation) will be able to fully practice this vocation outside their training institutions, how are the graduates perceived with regard to their training competencies, in relation to the opportunities that are offered in the current labor markets?

The purpose of the article is to present the existing discrepancy between the "politically correct" interculturalist discourse that, despite its deficiencies, in many cases manages to positively transform the opinions of students with respect to Mexican cultural diversity; and the situation that prevails outside the academic environments of the Intercultural Universities, specifically in the labor market. Two representative cases have been considered: the Intercultural University of the State of Mexico (UIEM) and the Intercultural University of Chiapas (UNICH).

The methodological approach was carried out with field work aimed at extracting the perception of the value of the intercultural graduate from the opinion of the graduates and the authorities of both institutions. This was done in reference to the entry and exit profiles and the professional practice of its graduates.

The article presents, initially, the approach that has addressed intercultural higher education in Mexico, in order to note the fundamental features from which the intercultural discourse is based, which permeates among its actors. As a second element, the methodological details through which an interview guide was designed and applied to young people recently graduated from the UNICH and the UIEM are presented, and it is indicated how the congruence relationship between the graduation profile (EP) and the type of work (T) in which the person was working at the time of the interview was evaluated. Finally, the part dedicated to the results presents the different versions of opinion, or perception, from the authorities of the two universities, as well as from the graduates who constituted the sample, in order to interpret the degree of success that the

Intercultural University has had up to now with regard to the insertion of its intercultural graduates and the goals, which are very ambitious, that they must meet, unlike conventional professionals.

2. The intercultural university

La Interculturality refers to a discourse that seeks to recognize the existence of contact and relations between different cultures. Although its conceptual construction could be the subject of wide debate, one can distinguish the acceptance of its ethical basis that includes the idea of respect and dialogue. In education, study programs based on interculturality have the purpose of supporting the recognition of existing cultural diversity, such is the case of Mexico, a country where the plurality based on ethnic groups is constitutionally recognized, which together corresponds to 10.1 % of the total population (INPI, 2017).

Unlike other cases in Latin America in which the participants of the original peoples have been the basis for the promotion of the intercultural educational model, in Mexico the model had an institutionalized origin under the auspices of the Ministry of Public Education (SEP). This educational model emerged in 2000 and has now spread to 11 universities in the following states: Tabasco, Michoacán, Chiapas, State of Mexico, Puebla, Guerrero, Veracruz, Quintana Roo, Hidalgo, Sinaloa and San Luís Potosí. The entire model offers 32 bachelor's degrees, six master's degrees and four doctorates (SEP, 2018).

The Intercultural University in Mexico was structured in accordance with the fundamental principles of Intercultural Education that emanate from UNESCO (2006)[1]. The incorporation of the principles of intercultural education into the field of university education resulted in the design and offer of a diversity of careers with differentiated profiles, in accordance with the specific environment of each university. Notwithstanding the above, it can be seen that, in general, both entrance and exit profiles seek to prepare a type of professional who will constitute a bridge for the organization, dissemination and promotion of those areas where the community or indigenous cultural strength lies (SEP, 2018).

However, these principles allow us to understand the relevance of adopting educational environments directed towards respect and tolerance, while allowing the ability to raise the levels of educational and labor competitiveness regardless of the ethnic or cultural status of its practitioners, but in reality, there is a distortion of its components. Erdösová (2013) had suggested that the intercultural university, although it refers to a unidirectional educational model, may differ in different social imaginaries and thus adjust to different types of interests.

Among the main purposes of intercultural education in Mexico, emphasis has been placed on helping traditional lifestyles and practices at risk, as is the case with the practices of groups that are sustained by their native languages. However, as often happens when the

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[1] Intercultural education respects the cultural identity of the learner by providing everyone with a quality education that is appropriate and adapted to their culture. 2. Intercultural Education teaches each learner the cultural knowledge, attitudes and skills needed to participate fully and actively in society. 3. Intercultural education teaches all learners the cultural knowledge, attitudes and skills to contribute to respect, understanding and solidarity among individuals, ethnic, social, cultural and religious groups and nations.

discourse goes beyond reality, the incorporation of intercultural education in Mexico has been distinguished by assuming an integrative orientation, so that it has sought to raise the skills of the population, at risk, so that their participation in the national and international environment is carried out in the best conditions; but it lacks a sense of full respect so as not to damage the original conditions.

With 20 years of existence of the Intercultural University model, it is not possible to speak of a failure, but it is possible to mention that its fundamental purpose is stagnant within a political environment that has allowed those in charge of the construction of educational policy to obtain a discursive solution to the demands of the groups, previously excluded.

In quantitative terms, the Intercultural University model in Mexico has not had the expected impact on its scope of coverage. Thus, for example, Aguirre (2015) indicated that in the year 2015 the Intercultural Universities as a whole attended a population that represented nearly 18% of the target population and only 4.3% of the potential; added to this, these universities face a severe problem of dropouts and undergraduate graduates, so it is generally mentioned that it has been a model whose perception is of uselessness within formal education.

3. Methodological aspects

This work considered the case of two Mexican intercultural universities selected for their representativeness with respect to the historical trajectory within the model of intercultural education. First, the Intercultural University of the State of Mexico whose academic offerings fall into six study programs: Intercultural Communication, Language and Culture, Sustainable Development, Intercultural Health, Art and Design, and Nursing (UIEM, 2019). Second, the Intercultural University of Chiapas where there are six degree programs at the higher level: Intercultural Communication, Language and Culture, Alternative Tourism, Sustainable Development, Intercultural Law, and Medical Surgery (UNICH, 2018).

Since the intention was to study the participants' perception of the model regarding their performance as intercultural graduates or professionals, it was proposed to develop a qualitative study that would allow for the collection of voice and opinion in two dimensions. First, the individual dimension, in reference to the relationship between cultural identity and professional practice, how is the intercultural graduate identified and valued? Second, the community dimension, to assess the capacity of intercultural education in promoting the development of communities of origin.

The first phase of the research was carried out by consulting official sources located through the National Association of Universities and Institutions of Higher Education (ANUIES), and other materials issued by the SEP; this part was complemented by direct consultations with personnel specialized in the follow-up of graduates from both selected universities. With this, an approach was made to the evolution in numbers of these universities, such as the degree of representation in reference to total higher education in Mexico, information was also recovered on enrollment and graduation, and a tracking of job placement of graduates was carried out.

The second part of the methodology was qualitative and was carried out through data collection using the semi-directed interview technique, with a structured sample that allowed access to testimonies at two levels: institutional, in accordance with the opinion of the authorities of the selected campuses, and with graduates. Twenty-one testimonies were

collected, divided equally between UNICH and UIEM, from the following degrees: Alternative Tourism (33.3%), Intercultural Communication (52%), Sustainable Development (9.52%) and Language and Culture (4.7%).

A random sample was determined for the graduates, without distinction as to the degree of graduation, gender or current occupation. The sample itself determined the status of the informants in terms of their origin from an indigenous community and their connection with a native language. The UNICH sample shows a greater presence of graduates from a rural or indigenous community, while the strong presence of the Tzotzil language is identified, either as the first language or as a traditional language within the families.

In the case of the UIEM, there was no presence of any native language as a first language, although the Mazahua and Otomi languages stand out in the order of use of family tradition. Table 1 shows the characteristics of the graduates interviewed.

Interviewed	Degree	Source	Cultural and linguistic status *
UNICH			
Teresa	Alternative Tourism	San Cristóbal de las Casas	TLI[2]
Gloria	Alternative Tourism	San Cristóbal de las Casas	Half-blood
Diana	Alternative Tourism	Pichucalco	Half-blood
Enoc	Alternative Tourism	La Frailesca	Half-blood
Santos	Alternative Tourism	San Pedro, Huixtan	HLI[3] tzotzil
Mario	Alternative Tourism	San Marcos Tulijá	HLI tzeltal
Juan	Alternative Tourism	Santa Martha, Chenalhó	HLI tzotzil
Sandra	Intercultural Communication	Ocosingo	TLI
Abelardo	Intercultural Communication	Amatenango de la Frontera	TLI
Miguel	Intercultural Communication	Carmito, Huitiupán	HLI tzotzil
Francisco	Intercultural Communication	San Martín, Pantelhó	HLI tzotzil
UIEM			
Edén	Intercultural Communicationl	Emilio Portes Gil, San Felipe del Progreso	TLI mazahua
Ismael	Intercultural Communication	San Felipe del Progreso	Half blood
Norma	Intercultural Communication	Atlacomulco	TLI mazahua
Yeni	Intercultural Communication	Jocotitlán	Half blood

[2] TLI: person with indigenous linguistic tradition in the family whose first language is Spanish, but, in addition, can handle in different degrees the respective original language; mestizo: person with Spanish as first language, without notion of indigenous roots in the family

[3] HLI: speaker of indigenous language as first language.

Rosario	Intercultural Communication	San Felipe del Progreso	TLI mazahua
Gaba	Intercultural Communication	San Pedro de los Baños, Ixtlahuaca	TLI mazahua
Hermilo	Intercultural Communication	Álamo, Veracruz (vive en Edomex)	Half blood
Alma	Sustainable Development	Rincón de la Candelaria, Atlacomulco	Half blood
Anayeli	Sustainable Development	San José del Rincón	TLI mazahua
Griselda	Language and Culture	Santa María Nativitas, Jiquipilco	TLI otomí

Table 1. Graduates interviewed and their personal characteristics

With the information obtained, two aspects were worked on. An indicator was prepared to assess the congruence relationship between the exit profile (EP) and the type of work (T) in which the person was working at the time of the interview. In order to estimate the degree of congruence between the profile and the job (PE/T), the contact with the communities (rural and/or indigenous) maintained by each graduate was considered as the first distinctive moment of each job position, given that professional performance in community contexts is the very basis of the approach to intercultural degrees.

A second aspect was to capture the perception that each one of the interviewees has about the relevance of having acquired an intercultural profile, together with identifying or verifying the relationship between their work status and their communities of origin. Additionally, it was taken into account whether the graduate puts into practice the skills acquired during the degree and whether he or she is aware that his or her university training was different from the conventional one.

4. Results

The success of each intercultural university can be measured by the performance of its graduates, that is, by the congruence between the characteristic of work performance and the corresponding graduation profile. The initial question is whether the potential of the educational model of the Intercultural University has been able to be expressed in a solid formation of graduates "of another type" who consequently act in society according to intercultural values, some specialists are optimistic, for example, Sartorello 2007.

What happens after the completion of an intercultural university education? Quantifying the placement of graduates on the labour market and their professional success is nothing new at any higher education institution. However, in the case of intercultural universities, the issue is more sensitive than elsewhere due to the special type of training and social function that it fulfils.

In the framework of the interculturalist discourse, for the graduates there are very ambitious goals, nothing less than to create new spaces in the existing labor market, saturated with the "conventional" professionals, using a formation specially designed to

bring comparative advantage to the indigenous youth (González Ortiz, 2007a, p. 80). And as Sartorello points out:

> I dare to suggest that these young people are being trained to be agents of change for their peoples and communities in order to help overcome the economic, social and political marginalization suffered by their people and, at the same time, to strengthen and revalue their own culture as a unifying element and creator of ethnic identities capable of resisting the onslaughts of Western urban culture (Sartorello, 2007, p. 4).

But how many graduates have actually managed to establish themselves in professional areas that are in tune with their intercultural training? How likely is it that former students (especially those who declare an "intercultural" vocation) will be able to fully practice that vocation outside their alma mater in the face of what Sartorello (2007) called the "onslaughts of Western urban culture" (p. 4) Both among the graduates and among the institutional workers there is the awareness that in the intercultural degrees there must be trained professionals who are different from the "conventional" ones. What is lacking is a consensus on whether flesh and blood graduates really fulfill this characteristic. First, the institutional vision shared by the rectors of both universities regarding the performance of their graduates must be reviewed.

The speech of Javier Alvarez Ramos, rector of the UNICH between 2011 and 2014, is characterized by two positions that are somewhat incompatible: awareness of the mission of the Intercultural University that must train "alternative" professionals for community work (limited by the reality that few alumni get to perform in this way by seeking rather conventional jobs), and the tendency to measure success according to parameters linked to competitiveness, good jobs and high salaries.

> I'd say our graduates have a 30% immediate placement. Unfortunately, not in the logic of the graduation profile that they return to their community. Two claims collide here, and one is cultural. In indigenous communities, leaving the community is a reason for progress. Returning is a reason for failure. Then we find a natural resistance of the boy to return to his community and our boys seek employment in the formal market. This is not the aim of the university. They are prepared to be able to manage projects and develop management of dependencies outside them and to set up cultural, productive projects from and with the community (Álvarez-Ramos, personal communication, 10-04-2014).

The rector's complacency in cases of young people with business placement, well established, is noted below, highlighting the case of a graduate marketing manager of Nissan brand cars who serves the indigenous clientele in their mother tongue. Although the rector is aware that it is not the desirable profile in which such a person should work, he cannot refrain from an enthusiastic tone when faced with such a "success story".

> We already have two companies of young students who are managers that perfectly fulfill the mission of the University and with quite success. We also have children who have set up their own business, there is someone who has a very successful restaurant there and produces his own food. We also have in formal employment, the marketing manager of Nissan San Cristobal; it is very clear to me that it is not his profile, but

why does Nissan hire him? The main consumer of the nissancita truck here in Chiapas are indigenous people and sales increased because the manager speaks in the indigenous language with the buyer. So there are success stories, but it is still a challenge for us that most of our children fulfill the mission that we have been entrusted with for the purposes of its exit profile (Alvarez-Ramos, personal communication, 10-04-2014).

For his part, Monroy-Gaytán, rector of the UIEM, at the time of the interview, in his speech described the performance of the graduates as rather satisfactory, although the need to recycle careers more often to prevent the regional market from becoming saturated was pointed out.

There are many (students) of Language and Culture who have gone out to the teaching side, which seems pertinent to me because there are teachers who do not speak the (native) languages, so devoting oneself to teaching with this value is positive. (The career of) Sustainable Development has gone a lot to non-governmental and self-managed organizations, doing projects in the (indigenous) communities. And Intercultural Communication has been linked to all regional and local media, such as radio. Because of the size of the area there should be a faster process of recycling careers and changing their profiles. The Intercultural University is going through a stage of reflection, restructuring, and realizing what its profiles are. For example, the degree in Intercultural Health: we did not understand well how the market is, what the profile should be. Today we have it clear: with a clinic, with an area of laboratories working on phytopharmacy, we already understand which is our strongest side (Monroy-Gaytán, personal communication, 08-05-2014).

The director stressed that the Intercultural University was in the process of defining itself and that its degree profiles were just crystallizing. This last argument also appears in the speech of Felipe Medina, responsible for the follow-up of UIEM graduates, who summarized the complications faced by the alumni. The academic considers as successful those graduates who did know how to develop within their profiles that involve community work.

We are a recently created university and we have to consolidate our image, so our graduates have serious problems of a thousand kinds, such as the degree, refresher courses, or being recognized by other institutions. We have a very low terminal efficiency, maybe 60% more or less, in degree by 20%. There is a lot of unemployment, unfortunately. We need to do a lot of work on the entrepreneurial graduate. In fact, that is the ideal of the Intercultural Universities that are being located in areas of high marginalization, that the graduates carry out development projects in their own communities and that they make an impact on this marginalization. Few, in fact, have formed civil associations that allow them to generate or obtain projects, which in turn have an impact on the communities. They are few, but we can mention some successful graduates (Monroy-Gaytán, personal communication, 08-05-2014).

As exemplified in the speeches reproduced, and beyond, the problems faced by graduates are multiple. The educational model of the Intercultural University is not widely

disseminated, coverage in a country as large as Mexico is reduced, and the large part of society is unaware of it, which becomes a problem especially when it comes to employers. Moreover, the model is wrapped in a fabric of beliefs, prejudices, stereotypes and criticisms to a greater or lesser extent justified, which consider it as segregationist, "for Indians", "for the poor", of low academic quality or simply as utopian and, therefore, incompatible with the country's globalized reality.

From the archives of the Intercultural Universities it was possible to obtain a series of data about the working conditions for the graduates of the universities.

Indicators	UNICH	IUEM
Scope or type of performance of the graduates employed	83% organizations or businesses 8 % partners 6% business owners	93% organizations or businesses 7% business owners
Contract type	35% of indefinite time 54% of defined time 11% other	54% indefinite time 33% of defined time 13% other
Income level (monthly)	25% less than 2 thousand pesos 48% 2 to 5 thousand pesos 23% more than 5 to 10 thousand pesos 3% unpaid (own plot, family business)	Average net income of 4 575 pesos
Performance based on contact with communities	45.5 % Yes 54.5% No	40% Yes 60% No
Reason for unemployment	78% for low wages 14% because they are waiting for the degree	52% for not finding a job 17% to continue studying

Table 2. Employment situation of UNICH and UIEM graduates Source: Own compilation based on Hartmann and López (2013) and Medina and Hernández (2014)

Table 2 shows that most of the graduates of intercultural universities depend on jobs in established organizations or businesses; a low percentage attend their own companies or businesses. The type of contract that they have assumed is mostly of a defined duration, or temporary, for graduates of the UNICH and mostly of an indefinite type for graduates of the UIEM, although this indicator is not relevant for evaluating the performance of an intercultural professional, because the types of contract can be assumed as part of the very make-up of the labor market.

In both cases, the average salary reported is low considering that they are professionals. This is an alarming fact when we know the testimonies of graduates, who indicate the existence of demerit for an intercultural graduate, as stated in the comments of graduates[4]

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[4] The states of Mexico and Chiapas are located within the group of 10 entities with the lowest average income level, below the national average (which corresponds to 6,405 pesos per month, about 330 dollars per month; STPS, 2020).

Despite the fact that the data on employed graduates, or not, was ambiguous, it has been possible to locate the problem of such performance. Graduates who stated that they were unemployed said that low salaries were the main reason. In this sense, a vicious circle has been formed; the situation for students is aggravated by the scarcity of economic resources, whether to complete their degree or to pay for their degree (the case of non-UNICH graduates is outstanding: 65%), which affects the quality of employment options, since without a degree, the young person does not receive a professional salary, but rather a technical salary.

Indicators	UNICH	IUEM
They work within the profile	34%	33%
Their work has little or nothing to do with the profile	60.6%	19%
Their Works is not related to the profile	5.4%	39%

Table 3. Consistency between the exit profile and the work (CE/T). Source: Own compilation based on Medina and Hernández (2014, p. 37) and Hartmann and López (2013, p. 13).

Continuing with the data extracted from the institutions, Table 3 presents the congruence relationship between the current exit and employment profile; in this field there is a similarity between both universities, since the registered graduates who work within the profile for which they were trained are: 34% for the UNICH, and 33% for the UIEM. However, for the UIEM there is a greater problem with regard to the conglomerate of graduates who declare that they work in areas that are scarcely, if at all, related to their profile.

However, the personal experiences, opinions and significant pieces of life narratives of former students opened the door to social action (both to their intellectual conception and to real practices) of this new type of professional. The following will show the perception of intercultural formation on the part of the graduates.

There are differences between UNICH and UIEM students regarding the reasons for entering intercultural studies. It seems that young applicants in Chiapas are more aware of the intercultural model. In this regard, among the main reasons that condition their entry were detected: the proximity and interest in the native languages, followed by economic factors along with identifying an innovative model proposed with alternative careers that could not be acquired in other models. On the other hand, in the UIEM, the applicants stated that economic difficulties and proximity to the University were the main reasons for their choice, followed by the factors that interpreted it as an innovative model. There is also a sector of students who made unfavourable comments about intercultural education, stating that it was their last option when in fact they were looking to participate in other educational models.

Scarcely, the perception of the interviewees was to have entered an educational model that would allow them to position themselves within the labour market in a full and advantageous manner. Most of them point out that the favourable part of intercultural

education was the attitudinal change they experienced throughout their career. This was due to the fact that they perceived a transformation towards valuing the model and the advantages that it can bring, although not related to the labour market but rather to a position of social and even altruistic focus. This allows them to understand themselves as potential promoters of change and development in their communities of origin.

In terms of the degree to which graduates apply the mission and vision of the Intercultural University in their workplaces, 36.4% of UNICH graduates say that the university's intercultural vision has not only transformed their way of thinking, but is also reflected in their way of working. The rest are less optimistic: there are those who simply do not have a job at the moment (36.4%) and others work in areas where intercultural dialogue is not promoted and their proposals are not taken into account (27.3%) (Hartmann and López, 2013, p. 16). In other words, the mission of the Intercultural University is not too much questioned but the situation prevailing in society and specifically in the labour market prevents it from becoming a real practice. UNICH alumni recommend that intercultural education should be expanded: as an institution (43%) and to expand its work (19%), in addition to hiring more qualified teachers (26%) (Hartmann and López, 2013, p. 17).

There are no comparable data on the UIEM, but according to Medina-Flores y Hernández-García more than half of the graduates are very satisfied or satisfied with their role of doing something useful for society (20% and 43%, respectively) and 15% and 57% said they were very satisfied or satisfied with putting into practice the knowledge acquired in the UIEM. This leaves the UIEM in a better light than the UNICH, or perhaps reflects a less critical attitude of Mexican graduates towards Chiapas. (Medina-Flores y Hernández-2014, pp. 28, 49). What is the particular situation of our informants and how far were they able to keep within their professional profiles?

It turns out that six graduates (three from the UNICH and three from the UIEM) have the highest possible PE/T congruence ratio, as they show positive work profiles. But there are also numerous cases of graduates who work in community settings and use the knowledge they have learned at the Intercultural University, even though they personally do not feel much influence from the intercultural training they have received (there are nine in total; five at the UNICH and four at the UIEM). There are also those who are not currently working in community settings and are not practicing their intercultural skills, but hope to do so soon: four Chiapas graduates who are employed by the Intercultural University were interviewed.

There are also cases where the PE/T is low or none at all. The situation for the graduate is the following: a) he does not work within his profile and this is added to his alienation from the community (three cases in the UIEM and none in the UNICH); b) he works within his profile but without being in contact with the communities (two cases in the UNICH); c) he works within his profile but without maintaining the intercultural approach and without working in the community (two cases in the UIEM).

Cases (b) and (c) are graduates of Intercultural Communication and are distinguished by one circumstance. In case b), the two graduates work in an Intercultural University, that is, they attend to the problem of cultural diversity in their work as communicologists, although they are not required to do field work. In case c) there is no such approach, since the first graduate worked in the area of communication for the police and the second for a private radio station.

In summary, all 11 graduates from Chiapas worked to a lesser or greater extent within their professional profiles, and approximately half of them also worked in the field. On the other hand, only four of the ten Mexican graduates were clearly working in accordance with their profiles and at the same time were working in community settings.

This is where the regional differences come in, which probably have to do with the different degree of cohesion and vitality of the original socio-cultural structures in both regions. This context provides more "intercultural" jobs for Chiapas graduates than for Mexicans who live in a mostly urbanized and industrialized area. However, the UNICH is not exempt from the problem either: the graduates interviewed from both Intercultural Universities frequently questioned the usefulness of intercultural training in the existing market and pointed out the difficulty of creating a new working space for themselves. Even so, in many cases, their vocation to dedicate themselves to occupations of an "intercultural" type was strong, although for the moment it could not be converted into real practice.

However, according to the competitiveness that could be denoted in relation to other educational models, the Intercultural University orients a rather altruistic performance, with the capacity to generate the promotion for the change of their environments of origin. And it is at this point where there is controversy when the graduate is valued in terms of his or her individual opportunities to address work performance. In fact, there are comments among graduates who assure that the model is far from their proposed achievements, identifying it as non-functional. The maximum aspiration perceived is to be able to occupy positions in teaching or in social research.

5. Conclusion

The Intercultural University is perceived as an alternative model that offers opportunities to young people who come mainly from rural or community contexts, and who otherwise would not have the possibilities of access to university studies elsewhere. The purpose of intercultural higher studies as seen in its different components (entry profile, exit profile, mission and vision) is, in fact, to create a type of professional who is differentiated by the fact that he or she is capable of dealing with the problems that arise in the context of multiculturalism. However, in real practice within society and the labor market, graduates do not find a clear way to insert themselves in the ideal conditions for which they were trained.

There is an official version that does not hide the problems that young graduates are facing, but one perceives a discourse of confidence in assuming that working spaces will slowly open up so that graduates may become promoters of development for local and regional contexts. In addition, those who direct these institutions emphasize that in view of the unfavorable economic conditions from which their students come, intercultural university education makes it possible to balance, to some extent, this situation of inequality. The majority of young people at both the UNICH and the UIEM come from families that do not have sufficient income to allow for high registration costs, perhaps tuition payments, transfers, accommodation, etc., for which the intercultural model is a unique opportunity.

Finally, the generalized perception that the interviewees had, indistinctly of the UNICH or of the UIEM, with respect to the relation existing between the profile of exit and the principles of the interculturality is of positive type. The graduates agree that the careers in which they participated have allowed them to develop an alternative and innovative type of

work that differs from conventional education because of the capacity to approach community spaces.

In spite of the above, the graduates make it known, through their testimonies, that in the work environment ignorance and discrimination for intercultural education permeates; they have realized that the salary level tends to be lower for them than that given to graduates from other educational environments. The possibilities for the development of their professions are not included in public or private programs that encourage their effective incorporation.

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Authors

ZUZANA ERDÖSOVÁ has a PhD in Latin American Studies from the Universidad Autónoma del Estado de México (2015, honorable mention and Ignacio Manuel Altamirano award) and a PhD in Romance Languages from Palacký University in the Czech Republic (2012). She has a Master's degree and a Bachelor's degree in Humanities from the same university. Since 2016 she has been working as a full-time research professor at the Centre for Research in Social Sciences and Humanities (CICSyH) of the UAEM.

She is the winner of the XIV edition of the Ibero-American Award (Czech Republic, 2009), candidate for National Researcher (SNI) and has the desirable profile PRODEP. She is the leader of the Academic Body "Societies and Cultures of Latin America" attached to the Ministry of Public Education in Mexico. She is the author and co-author of several dozen scientific publications on topics related to her line of research "Interculturality, Education and Language in Latin America". She has been a speaker at various national and international scientific forums and has directed different research projects. She has worked as a translator, interpreter and also as a promoter of academic and cultural cooperation between Mexico and the Czech Republic.

RAFAEL JUÁREZ-TOLEDO obtained his PhD in Social Sciences from the Faculty of Political and Social Sciences of the Autonomous University of the State of Mexico in 2015. He is a teacher and has a degree in Economics from the same University. Since 1996 he has been a research professor at the Faculty of Economics of the Autonomous University of the State of

Mexico. He has also worked as a professor by subject at the Instituto Tecnológico de Toluca. He has the desirable profile PRODEP. He belongs to the Academic Body: Economy, Education and Sustainability, assigned to the Ministry of Public Education in Mexico.

His main lines of research are related to socioterritorial studies, social exclusion and poverty, migration, sustainability and new aspects of the economy, and complexity studies. He has participated in different types of publications: didactic material, magazines and books.

Construcción de la sexualidad infantil en el ambiente familiar

Construction of infant sexuality in the family environment

Martha Quirola-Larrea
Universidad Central del Ecuador, Quito, Ecuador
marthaquirolal@hotmail.com
https://orcid.org/0000-0003-1637-6507

Cecilia Jaramillo-Jaramillo
Universidad Central del Ecuador, Quito, Ecuador
cjaramilloj@uce.edu.ec
https://orcid.org/0000-0003-0182-9315

Resumen

La construcción de la sexualidad infantil se halla invisibilizada en la sociedad. Las personas adultas consideran que los niños y niñas infantes son seres asexuados y subsisten los tabúes alrededor de la sexualidad humana. Ocultar el tema mantendrá la ignorancia sobre la sexualidad infantil. La investigación sobre la sexualidad generalmente ha estado dirigida hacia la adolescencia como supuesta etapa en la que la sexualidad aparece en el desarrollo humano. El objetivo es verificar si mediante un proceso formativo cambian las formas en cómo los padres/madres de familia procuran formación e información sobre la sexualidad a sus hijos e hijas. Se implementó un programa de sexualidad infantil con representantes legales de un Centro de Desarrollo Integral para la Primera Infancia de la ciudad de Quito. Esta investigación es de tipo cuasi experimental. Se aplicaron encuestas de entrada y salida a los actores directos e indirectos del programa, divididos en grupos experimental y de control. La conclusión final es que el programa tuvo un impacto significativo en el cambio de perspectiva de los padres/madres de familia. Incluye las prácticas de diversas posibilidades de educación sexual con sus hijos e hijas. De igual forma, se presenta la posibilidad de educar a progenitores en los ámbitos escolar y comunitario para mejorar la calidad de vida y de gestión familiar.

Palabras clave

Creencias, familia, género, infancia, sexualidad.

Abstract

The construction of infant sexuality is invisible in society. Adults consider infant children (boys and girls) to be asexual and taboos about human sexuality persist. Hiding the topic will maintain ignorance about child sexuality. Research on sexuality has focused on puberty and adolescents as periods of sexual development in humans. The objective is to verify if, through a training process, the ways in which parents provide training and information about sexuality to their sons and daughters change. An infant sexuality program was implemented for the legal guardians of the children in an early childhood program in the city of Quito. This research is quasi-experimental. Survey will be given at the beginning and end of the program to people directly and indirectly responsible of the program. Additionally, there will be an experimental and a control group. The final conclusion is that the program had a significant impact on the change of perspective of the parents. It includes the practices of various possibilities of sexual education with their sons and daughters. In the future, there is the possibility to educate parents in the school and community environment to improve the quality of life and family management.

Key words

Beliefs, family, gender, infancy, sexuality.

1. Introduction

The scientific literature on child sexuality is limited. The emphasis placed on adolescence as the main focus of investigative attention to human sexuality has restricted the inquiry of the childhood period. An essential factor of incidence is that there is the idea that children are beings (Hernández and Jaramillo, 2003). Thus, child sex education, as the management axis of some projects and programmes, is developed with preponderance in educational institutionality. When implemented in the family environment it is usually complementary and subsidiary to school.

Family competences are applied in a fledgling way or simply not implemented in terms of sexuality training and information. Therefore, the recurrence of parents to hide the genital organs and their physiology in colloquial, inaccurate and inappropriate language. The teaching practices that adult family members apply in everyday life contribute to a formation full of fears, feelings of shame, guilt, and unfounded beliefs that rather disturb and inhibit sexual expressions.

The research purpose includes characterizing the use of language and maternal-parental educational strategies in child sex education. It is also necessary to see their influence on the knowledge, beliefs and attitudes of the sexuality of infants aged 4 to 5 years. This research covered a child sexuality program developed with the mothers and parents of a Center for Integral Development for Early Childhood Tax Support. The hypothetical approach was that the implementation of this programme will influence the parent strategies applied in the family environment so that it has an impact on the notions that girls and boys can learn or assume.

The document was presented as research work in the Master of Initial Education at the Faculty of Philosophy, Letters and Educational Sciences of the Central University of Ecuador. It contains some theoretical elements for conceptual framing and the methodological process applied. Then the results obtained and their respective analysis and discussion are presented. Finally, the conclusions and literature consulted are available.

2. Related Concepts

2.1 Historical and legal references in Ecuadorian educational institutionality

In Ecuador, policies and programmes that have been implemented in terms of sex education have their eyes on adolescent students. The most important effort that in the field of sexuality education has made the Ecuadorian state, was through the Ministry of Education. It was developed from the Sexuality and Love Education Act enacted in the Official Register 285, in 1998, as considered in Ministerial Agreement 403 (Official Register 386, p. 1). His organization was carried out with the National Education Plan for Sexuality and Love in 2000. The execution was formalized through the National Sexuality and Love Education Program (PRONESA) in all Provincial Directorates of Education. In this way, its implementation in the schools of the basic and high school levels of the educational system was sought.

Subsequent to this national policy, other processes have been developed that have been translated into substantive regulations that describe efforts regarding compliance. So you have: Ministerial Agreement No. 3393: Special Regulations and Mechanisms for the Knowledge and Treatment of Sexual Offences in the Educational System (Official Register 431,2004, p. 4-8). Ministerial Agreement No. 403: Institutionalizing sex education in the country's tax, private, physcomest and municipal educational establishments through the PRONESA (Official Register 386, 2006, p. 14-15). Executive Decree No. 620: Declaration as a State Policy of the "National Plan for the Eradication of Gender-Based Violence against Children, Adolescents and Women" (Official Register 171,2007, p. 3-4). Ministerial Agreement 062: National Plan for the Eradication of Sex Crimes in education (Ministry of Education and Culture, 2006).

The Inter-ministerial Agreement No. 0247-2018 of the year 2018: Intersectoral Policy on the Prevention of Pregnancy in Children and Adolescents Ecuador 2018 - 2025 (Official Register 529, 2018, p.1-44) In its extract it states that pregnancy in children and adolescents is a social and public health problem. It shows inequality, social injustice and a clear violation of human rights, with an invaluable social, economic and cultural impact. The Ministries of Health, Education, Justice and Economic and Social Inclusion participate in this policy.

The Educating in the Family Programme promoted by the Ministry of Education 2015 takes a comprehensive approach to education on sexuality and affectivity. It is the broadest and most inclusive effort that the ministerial body has in this area and is being fully implemented.

A preliminary evaluation of the actions, processes and implementation of the legal regulations mentioned indicates that there is partial implementation of the policies. This is due to the scarcity of financial resources needed for their implementation, the low availability of the required human talent and the insufficient coverage of such programs. These elements mean that the underlying social problem is contained in some educational institutions and sectors and has increased in others. No policy has been directed towards

the preparation of parents and early education students. State decisions to provide for the training of parents and students are not a starting point in the training process for these social subjects. A comprehensive process at all educational sub levels and with the involvement of key actors, quality sex education can be achieved.

2.2 State of Play

For this study, the family environment is the space in which the teachings on notions of sexuality applied by mothers and fathers are developed. The forms and strategies are based on their own knowledge that includes the knowledge, beliefs and attitudes around the subject. The family environment is permeated by elements of community and social culture that influence their educational actions. The research has among its principles the gender focus as a conceptual and analytical category. It makes it possible to understand, explain and transform the relations of inequity, domination, discrimination and violence existing between men and women. This is not only based on sex, but also in relation to age, ethnicity, class and sexual options, according to the guidelines for the inclusion of the MINEDUC-VVOB (2019). Gender is assumed to be the "set of practices, beliefs, representations and social prescriptions that arise among the members of a human group based on a symbolization of the anatomical difference between men and women. (Lamas, 2000, p. 2). This concept accounts for the way human beings are socialized according to the sex they are born with.

According to Julia Suárez, stereotypes are preconceptions, simplified and generalized ideas about a group of people. According to the MINEDUC-VVOB guide (2019), gender stereotypes are caricatural beliefs about female and male groups (Suárez, 2016). Androcentrism is a view of the world referenced around men in masculine terms and the reconstruction of the sociocultural from that perspective. They contribute to the devaluation of the former and the valuation or overvaluation of the latter, in accordance with the unequal social order between the sexes.

It is important to specify that sex has to do with the biological, anatomical, morphological, chromosomal and physiological characteristics that define men and women. Sexual orientation determines the sex of people for whom there is attraction, desire, love and interest (MINEDUC-VVOB, 2019). In this field we must consider homophobia, which is the fear or hatred of homosexual men and women. Sexual identity "includes the way a person identifies as a woman or a man, or a combination of both, and the person's sexual orientation" (WHO/PAHO, 2000, cited by Alcantara, 2012, p. 1). Gender identity "has to do with how people feel male or female and their own deep-seated experiences. (National Council for Gender Equality, 2018, p. 34). The starting point then is that sex equals biological and gender equals cultural.

Heteronormativity is defined as "the political, social, philosophical and economic regime that generates violence towards all those people who do not follow a pattern of gender, sexuality, practices and desires associated with heterosexuality" (Moreno, 2019, p. 6). Inequitable relationships based on gender are normalized and accepted in society. Among the concepts assumed is that of androcentrism, which refers to "the vision of the world that places men as the centre of all things, constructs a masculine view as universal and unique as possible, and entails the invisibility of women and their world. (Morales, 2013, p. 3). From this position, men are historical and social subjects of action, while women are more objects than subjects, since they are acted upon. Anthropologically, patriarchy is understood as "an organization of the world in which men and the masculine are established as dominant and constitute a system of beliefs and ideas that structure the way we see and understand the

world. (Rosso, 2016, p. 2). The imposition of heterosexuality on other sexual identities has become naturalized in society. So have the cultural patterns that impose the power of men over women in general.

Finally, we take the concept of sexuality from the World Health Organization (2018) which defines it as:

> A central aspect of the human being that is present throughout his life. It covers sex, gender identities and roles, sexual orientation, eroticism, pleasure, intimacy and reproduction. It is felt and expressed through thoughts, fantasies, desires, beliefs, attitudes, values, behaviors, practices, roles and relationships. While sexuality can include all of these dimensions, not all of them are always experienced or expressed. Sexuality is influenced by the interaction of biological, psychological, social, economic, political, cultural, ethical, legal, historical, religious and spiritual factors (p. 3).

The nuances that each of these concepts and others that are linked, are understood from the inclusiveness and rights approach. Thus, the framework of concepts helps to understand a specific socio-educational reality such as the construction of child sexuality in the family environment. This social space includes fundamentally the parents as affective and knowledgeable references for children. It is assumed as a "construction" since different aspects of sexuality are learned.

3. Methodology

3.1 Population and sample

The student population of the Virginia Larenas Center for Integrated Early Childhood Development is 438 children. The population of parents and legal representatives is 430. The sample was made up of 20 legal representatives from the experimental group and 20 from the control group, equivalent to 9.3% of the population. The student body of the experimental group was composed of 20 children aged 4-5 years, corresponding to the experimental group of parents. The control group was 20 students from different parallels taken at random. These groups correspond to 9.1 per cent of the population. All individuals in the student survey were in the age group 4-5 years.

3.2 Research design

The operational design of the research was quasi-experimental with the intervention of an experimental and a control group. The formation of these groups was based on the list of participants provided by the educational institution. The development of the child sex education program was determined with the experimental group. The application of the entry and exit surveys (test and retest) to both groups was also determined. The test and retest are questionnaires that investigate knowledge, beliefs and attitudes about child sexuality. These instruments were used to determine the incidence of the applied training program.

The application of the test and retest of the experimental group was with the same people who participated in the program. The application of the retest of the control group was with different people than those who answered the test, although from the same educational institution. Thus, the characterization is that it is a pre-test - post-test design with a non-equivalent control group (Murillo, n.d. p. 25). The instruments for data collection were

questionnaires. In the case of the parents, it is composed of 36 items of different types: checklist, Likert-type assessment scale, and open-ended questions. For the student, it had 18 items with checklist and open-ended questions. Anecdotal records were made of relevant aspects of the child sexuality education program applied to the experimental group of mothers and fathers.

3.3   Intervention program: Family Sex Education Program-PSIF

The Family Sex Education Program (FSE) is a sex education process for parents of young children. It was designed by the author of this article. It contains the justification, objectives, general pedagogical and methodological guidelines, workshop cycle and bibliographical references. There is a social environment of media overexposure to sexuality, which requires sexual education in natural spaces for children. The pedagogical principle assumed is that the family environment is the ideal one for achieving a comprehensive education for children. The programme provides information and guidance on aspects that parents do not know how to transmit. It takes into account that some knowledge, beliefs and attitudes are the product of ignorance regarding the development of the child.

The FIPP has two objectives: 1) To reflect on the importance of sex education in the family environment; and, 2) To identify attitudes and actions that parents should have or apply so that they help their children to know and respect their bodies, establish sexual differences between men and women, and reflect on gender differences. The training cycle involves eight workshops of 1.5 hours each, for a total of 12 hours of management. Each workshop includes its respective agenda with its title, specific data, objective, activities, resources, evaluation, and specific bibliographic reference.

4.   Research Result

In the first part, the surveys asked some socio-demographic questions to establish characteristics of the group of legal representatives who applied the instruments. For this article we have the results corresponding to sex, academic training and religiousness.

Options	GE-PMF		GC-PMF	
	f	%	F	%
Men	3	15	0	0
Women	17	85	20	100

Table 1: Sex of participating parents

In the exit survey, the Parent Control Group (PCMC) has 100 % women. In the Experimental Group of Parents (GE-PMF) 85 % of women and 15 % of men. There is therefore a majority presence of women, which is very common in the educational institutions of the sector (Table 1).

Seventy percent of participants in the GE-PMF have a high school diploma and 25% a university degree. The GC-MFP, claims to have basic training 55%, secondary 30% and university 10% (Table 2).

One element to be known was the relationship between the beliefs and knowledge that mothers/parents have about sexuality and its effects on the notions of their children. Hence the importance of knowing if they profess any religion. Fifty-eight percent claim to be non-believers and 42% claim to be so (Table 3). The responses are surprising for a society like Ecuador's and for the sector of the population surveyed.

Table 4 shows the results in terms of the impact that the PSIF had on the experimental group. This is both in relation to the control group and to itself. The significance for this study was established in four ranges: Very significant, Medium significant, Not very significant and Not at all significant.

Opciones	GE-PMF		GC-PMF	
	f	%	f	%
None	0	0	1	5
Basic (complete or incomplete)	1	5	11	55
High school (complete or incomplete)	14	70	6	30
University (complete or incomplete)	5	25	2	10

Table 2: Educational level of participating parents

Options	GE-PMF		GC-PMF	
	f	%	f	%
Yes	7	35	8	40
No	13	65	12	60

Table 3: Do they profess any religion?

Aspects of the Research	Items	Level of significance of Parents			
		A. Experimental group vs Control group B. Impact in group experiment (test vs retest)			
		Very significant	Mildly significant	A little significant	Not at all significant
Development of sexuality	10	✓			
Age of mediation	11	✓			
Defined sexual orientation	12		✓		
Educational mediation	13. 14		✓		
Obtaining information	15		✓		
Child masturbation	16. 17	✓			
Clarity of information	18.19	✓			
Fears about sexuality	20		✓		
Perception of mediation capacity.	24	✓			

		Very significant	Mildly significant	A little significant	Not at all significant
Sex education stimulates sexual activity.	25. 26	✓			
Sexuality as pleasure	27			✓	
Heteronormativity as a cultural pattern	28	✓			
Exclusive sexual practices within marriage	29		✓		
Men's initiative in sex	30	✓			
Active sex life as a male right	31	✓			
Active sex life as a woman's right	32	✓			
Relationship between religious teaching and sexuality.	33				✓
Search for information.	34		✓		
Assessment of sex education received.	35		✓		
Masturbation as a harmful situation	36	✓			
20 aspects researched (100%)	24 ítems	11 55%	7 35%	1 5%	1 5%

Table 4: Levels of significance of the impact of the PSIF of the experimental group of parents in relation to the control group and in relation to their own development

Aspects of the Research	Number of Items	Level of significance in students			
		C. Experimental group vs Control group			
		D. Impact in group experiment (test vs retest)			
		Very significant	Mildly significant	A little significant	Not at all significant
10 (100%)	16	6	2	1	1
		60 %	20 %	10 %	10 %

Table 5: Levels of significance of the impact of the PSIF of the experimental group of students in relation to the control group and in relation to their own development

For the experimental group of mothers/parents, it can be inferred that the PSIF had an important impact with a medium and high 80% significance. The aspects of little or no significance are those that were not addressed due to issues of the program's curricular structure. This is the case of the absence of information on the genital apparatus of men

and women. It also depends on the intentionality of the program as it is the laicism that was maintained in its application.

As a statistical summary, in the case of the student body, Table 5 shows that the level of significance is 60% "Very significant", 20% "Moderately significant", 10% "Not very significant" and 10% "Not at all significant".

The Spearman correlation coefficient was also used to relate data. This is because the research corresponds to a non-parametric correlation: a) it has a sample of less than 30 individuals, b) it does not necessarily have a normal distribution, c) it has psycho-social variables that were quantified (Camacho, 2008). The application was made with fourteen items whose indicators contain correct answers and better responses.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
GC-t	0	0	0	0	0	0	5	5	5	10	20	35	40	40
GE-t	0	0	10	10	15	20	0	10	25	15	15	45	35	65
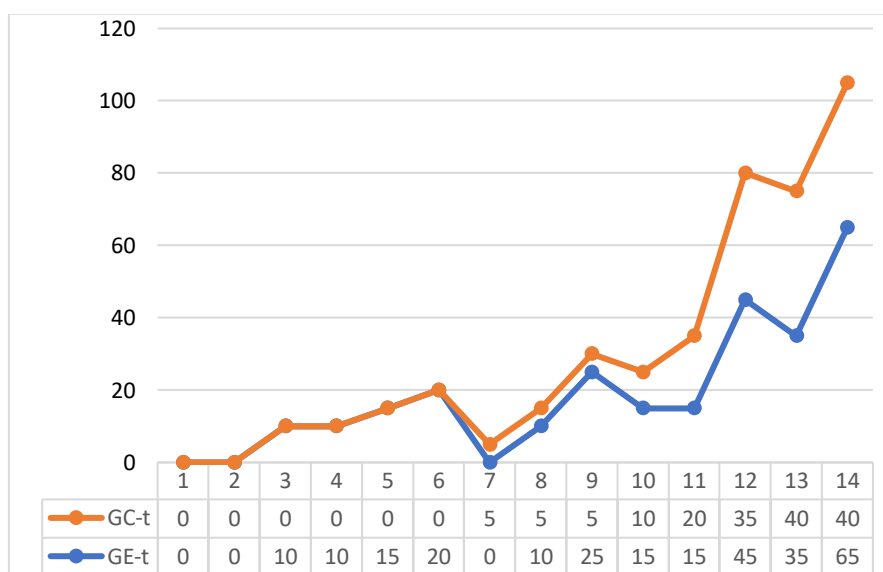
Figure 1. Spearman 1 Correlation: Experimental Test Group - Control Test Group

For the Spearman 1 coefficient (Figure 1), the Experimental Group and the Control Group were correlated with the data obtained in the test or input survey. The Spearman correlation coefficient obtained is 0.84, which is between a "considerable positive correlation" and a "very strong positive correlation" (Cabrera, 2011, p. 81). The two groups respond in a very similar way and their characteristics in terms of knowledge, beliefs and attitudes about sexuality are quite similar.

For the Spearman 2 coefficient (Figure 2), the Experimental Group and the Control Group were correlated with the data obtained in the retest or exit survey. The Spearman correlation coefficient obtained is 0.16 which is characterized as a "very weak positive correlation". Two different groups are presented in their knowledge of sexuality, as a result of their participation in the Experimental Group's PSIF sex education program.
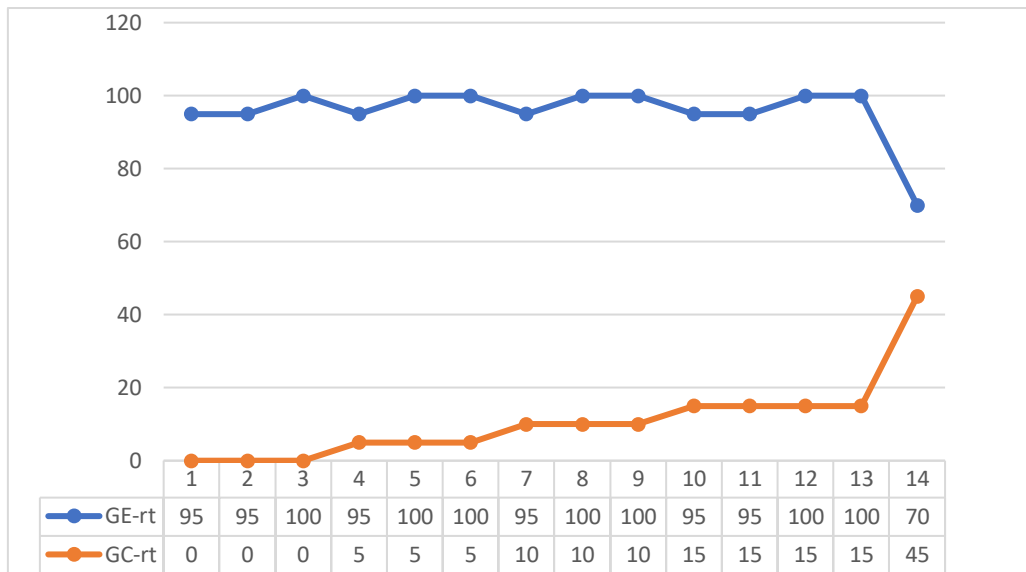
Figure 2. Spearman 2 correlation: Experimental retest group - Control retest group

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
GE-rt	95	95	100	95	100	100	95	100	100	95	95	100	100	70
GC-rt	0	0	0	5	5	5	10	10	10	15	15	15	15	45
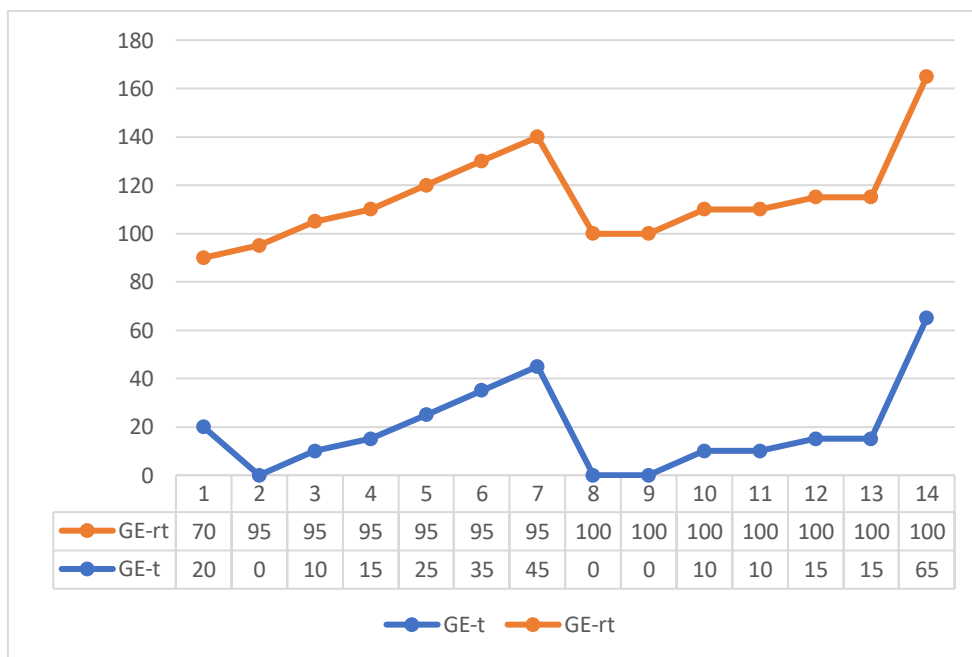
Figure 3. Spearman 3 correlation: Experimental test group - Experimental retest group

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
GE-rt	70	95	95	95	95	95	95	100	100	100	100	100	100	100
GE-t	20	0	10	15	25	35	45	0	0	10	10	15	15	65

For the Spearman 3 coefficient (Figure 3), the Experimental Group was correlated in their answers to the test and in their answers to the retest. The Spearman correlation coefficient obtained is 0.06 which is characterized between "no correlation between the variables" and a "very weak positive correlation". The comparative differences in knowledge, beliefs and attitudes towards child and human sexuality in general are very wide as an impact of the FIP. Knowledge, beliefs and attitudes changed significantly at both points for this group of mothers and fathers.

5. Discussion of results

The fact that the majority of women are involved in the primary care of children shows that mothers are almost exclusively responsible for their children. By extension it is assumed that this is common in Ecuadorian society. It is the result of a division of responsibilities with a strong gender inequitable component that is maintained in this local population and at the national level. As Royo (2011) points out, "in domestic tasks such as education, it is where there are disparities between men and women that an asymmetrical distribution of family work exists" (p. 120).

With regard to educational level, it can be inferred that the higher the level of education, the greater the interest in training as parents. It should be noted that membership of the PSIF was voluntary. The willingness to broaden knowledge is explained by the need to form an educational background in each of these persons.

One of the essential questions is to know the criteria regarding whether children's sexuality develops naturally or instinctively. There is an initial preference among mothers/parents of both groups to accept that sexuality develops without the intervention of adults. This tendency is repeated in the GC-MFP in the exit survey.

The GE-PMF group, passes in the retest to 5% in their affirmative answers which is considered as very significant. The learning path of the GE-MFP, as a product of their participation in the FIP, leads them to consider sexuality beyond genitality. This is the result of the program's approach, which reflects on the fact that sexuality involves the affective interrelationship of people. It occurs in the family and school context, and involves the emotional closeness of the mother/father and child bond, or other family members. This group sees sexuality as the discovery of themselves as human individuals and of others through social interactions. It is assumed then, as stated by Barriga-Jiménez (2013), that "sexual behavior, like any other behavior, is shaped in the process of socialization from the earliest age" (p. 3). The parents of the GE-PMF become aware of the importance of this socialization through the FIP.

The influence of the FIP is evident in changing perceptions about the age at which sexuality dialogue should be initiated. The GFMD believes that it should be from birth. Thus, there is a dislocation of the naive, very widespread idea of the asexuality of girls/boys. The group consider it is necessary to dialogue about sexuality from birth in a perspective of acting proactively in education and behaviour prevention. This change implies a break with a series of common errors that parents have in their personal positions as a result of a social attitude towards sexuality. Among the errors are the manifest disinterest of families in the subject of sexuality, that infants will learn on their own, the argument that they now have more opportunities than parents had in their childhood, that sexuality begins at puberty, that these subjects will be dealt with at school and that teachers will save them work and worry. Font (2002) further mentions that it is thought "that sex education encourages sexual practice, and that different sexes must be assigned different tasks" (p. 48). Mistakes arise from the mistakes made in one's own individual and family histories. The sad fact is that in most cases the anachronisms have been reinforced by the formal education system.

Another issue that had a very significant change was with respect to child masturbation. In the baseline data of the two groups and the output of the GC-MFP, the responses are directed towards repressive behaviour or supposed parental indifference. The GE-PMF responds in the retest with more adequate alternatives for a parental educational intervention that

attends to the emotional side and better psychological development of girls and boys. This is an expression of assuming in a more sensitive way the intervention of adults. The reflections of the PSIF considered the child's curiosity factor and body self-recognition when the child is touching or rubbing his or her genitals with his or her hands. In addition, there should be a pause by the parent to assume a response that is not impulsive or even aggressive. In the closing of the event, have a conversation time to talk about the indispensable privacy of these touching behaviors.

It is very clear that the transformation of beliefs, knowledge and attitudes regarding child masturbation is possible. This transformation seeks a comprehensive and harmonious sexual education of children and the family in general. There is no difference in terms of gender and the responses of parents are very similar regardless of the sex of their children.

Another important transformation is related to the intra-family dialogue of the complex issues of human sexuality. The GE-PMF leads to this communicational exchange being clear, truthful and concise, which shows an innovation in its cognitive and attitudinal structure. This change agrees with Luisi (2013) who says: "an explanation is necessary more than a prohibition, otherwise, children grow up disoriented, with doubts that will be solved with the less indicated person and with information that is not completely correct" (p. 5). These people most of the time are not your father or mother, but another friend who only feeds the confusion.

To meet the objective of investigating the use of language applied by mothers/parents on child sexuality, they were asked to write the designation to human genital organs in their community and family environment. The answers for "the female genital organs" were: chepa, chepita, chucha, conchita, cosita, cuca, cucaracha, pajarita, paloma, palomita, cocks, pollita, pulp, sapito, sapo, tortilla, vagina. For "the male genitals" the answers were: buddy, thingy, snake, ass, sparrow, güevo, egg, egg, mandingo, bird, stick, stick, dove, pigeon, dove, penis, penis, penje, pepe, pepito, pincho, pee, pito, banana, chick, chicken, cock, vevo,

The names given are part of the inventive and illustrative terminology of the popular heritage. These ways of calling the genitals express in a generalized way the taboos and myths that subsist in society. Amaya, (2005) states that "in this way ignorance, the limitation of knowledge and the fact that human expression, as essential as sexuality, is developed with distortions and deviations, are maintained" (p. 1). Designations other than those that exist in the Spanish language will produce confusion in children. Because of their training, it is difficult for adults to pronounce the correct names for the genitals. In this, "surely the learning ability of their infant children is being underestimated" (Mateo-Morales y Represas, 2007, p. 251) and this has been evidenced in the classroom coexistence by nursery school teachers.

There is an idea that children are protected from sexuality by hiding or restricting information, but it is also distorted, as in the case of the naming of genitals, and that it is a characteristic of society. "Child sexuality has been seen as a growing problem Today children who show great sexual interest continue to be judged as deviant or abnormal" (Molina et al., n.d., p. 2). The transformation of beliefs about sexuality is feasible with specific and profound reflections such as those developed in the PSIF. This complex and enriching educational process makes it possible to address the problem of information/training on sexuality from a human perspective.

One issue that tends to be accepted even at the level of educators is that talking about sex stimulates the sexual activity of children and young people. This idea is changed very significantly with the FIP. The experimental group of parents expressed their disagreement with this statement which has become a myth of sex education.

Among the topics consulted, the GC-MPF considerably increased their fear that their son or daughter is homosexual. This increase in fear could be explained by the ideological environment that was produced in the approval of equal marriage at the time of the research. The GE-PMF remained stable in response rates. It is inferred that the experimental group was able to face the conservative media avalanche through personal reasoning and explanations in the development of the educational program. This group surely evaluated the positions set forth in the Constitutional Court's resolution. In this way, it assumed what they considered to be the adherence to the rights approach that was one of the axes of the PSIF.

Two aspects that were developed have to do with the androcentric vision and can be translated into strategies for teaching about sex. It refers to sexual initiative and active sexual life as a cultural heritage or exclusive right of men. These issues refer to male dominance over sexuality that is naturalized in society and accepted by both men and women. Bourdieu (2000) specifies that "the strength of the male order is discovered in the fact that it dispenses with any justification: the androcentric vision imposes itself as neutral and does not feel the need to enunciate itself in discourses capable of legitimizing it" (p. 24). The principle of heteronormativity and the masculinized cultural pattern affecting society is ratified.

This arbitrary hegemony has been fractured, probably initially but very evidently by the PSIF as shown by the comparative statistics between the GE-PMF and the GC-PMF. It encourages the possibilities that with an educational process, these canons, which are very deepened, can be disrupted. It is possible that this group of women and men will walk a path towards gender equity, facing norms imposed by the patriarchal society.

In the statistical results of the research, no gender differences are evident. In the first place, it should be considered hypothetically that there are gender differences in the sex education of female and male infants. Mateo-Morales and Represas (2007) point out that "when we talk about sexuality, we also transmit feelings, ideas, values and prejudices generated from our own experience" (p. 17). It can be reasonably understood that gender differentiations slide very subjectively in the tone of voice, the type of words used, with the reactions of the face and body, with the silences and responses, among a wide range of linguistic and paralinguistic communicative possibilities. Secondly, it would be an interesting topic to investigate gender constructions at early ages.

The aspect that the PSIF could not influence and from there its null significance has to do with the relationship between religion and sexual education. The FIP programme in which the EG-MFP participated did not contribute to this topic because the process was approached from a secular perspective and with respect for the religious beliefs of those who attended. The refusal of the group of participants to allow religious institutions to address sex education is due to the secularization evident in the statistics. The rupture comes from the same society that does not see with good eyes the religious practices of its priests, pastors, elders or the same believing population.

We will now proceed to analyse and discuss the statistical information obtained from the student surveys. These were conducted in individual interviews at the Virginia Larenas Center for Early Childhood Development. The experimental group of students (GE-E) are those sons and daughters who are assumed to be indirect participants in the research, since their mothers or fathers attended the PSIF workshops. The control group of students (GC-E) were those whose representatives did not participate in the program.

For all students in general, it is not difficult to locate body parts such as nose, leg, and belly. However, pointing out their genitals ("Penis/Vulva") is no longer as easy in the two GC-E entry and exit surveys. It is statistically evident that what was learned in the PSIF by their parents was developed in the EG-E. This is in the sense that the genitals should be given the appropriate names. In addition, that it can or should be done in a spontaneous, natural way as it is done with the other parts of the body.

The location and naming of the genitals is changed from a traditional prohibition to an indicator of healthy sexuality. It is possible, through educational processes of cultural deconstruction, to unlearn these kinds of socially imposed proscriptions towards the family and individuals.

When you find out about the shame of talking about the external sex organs of men and women, there are important changes. The significant impact on the experimental group of parents shifted to that of their children in overcoming this attitude to their bodies and fundamentally to their own genitals. It is necessary to specify that the GC-E keeps intact this fear or discomfort when they talk about the penis or the vulva in public. This is due to the cultural pattern in their family and community environment that results from talking about the sexual organs as something lewd and that must be hidden.

In the question of whether they like to touch their genitals, the majority and total answer is yes for both groups of students. In this issue, there is also no evidence of differences between girls and boys, and no gender contrasts can be established in the answers. The boys and girls complemented their answers by referring to the fact that they like to touch each other "but that they don't let me" by their parents and that will be seen in the following aspect.

The analysis of information corresponding to children's responses to what their parents do when they masturbate requires a qualitative rather than statistical look. A good part of the responses is directed to parental anger ("She gets angry", "She gets angry"), to cut the behavior untimely ("Let me stay still"), to verbal responses ("She talks to me"). These perhaps impulsive parental reactions are typical of the inability to deal with situations of child eroticism and are impregnated with adult-centred attitudes and beliefs. There are situations in which fear is instilled ("He's going to send me to the doctor", "He's already washing him"). Possibly there is also concern about health in answers such as: "Is it going to bite me?

In the GE-E the answer: "It doesn't burn my hands anymore...we already forgive each other" of a student, surprised by the manifest emotion. The situation was corroborated by the mother's crying. Before her participation in the PSIF, when she saw her son touching her genitals, she would take a spoon, heat it on a stove in the kitchen and burn the boy's hands. The mother understood after the program that masturbation, as an exploration and satisfaction of the child's curiosity about his own body, was in no way harmful to her son.

So, the mother apologized to her son, the two of them hugged and cried over the experience before and after.

Most of the answers given by the children of the GE-E, show that their mothers and fathers have a more inclusive and humane attitude towards child masturbation: "He tells me to touch myself", "That only I can touch my penis", "He doesn't hit me anymore", "He says I should touch myself", "He doesn't talk to me anymore". The maternal and paternal attitude behind the child's responses also shows that there is a communication bridge. It provides an opportunity for children and young people to talk to their parents about sexuality with greater openness and confidence.

To the question "How did you hear them tell you to "make love"", approximately half of the students in the two groups of infants, in the test and retest, answer: "Nothing" "Doesn't know/No answer mom/dad". Disdain for sexual relations is already expressed at this age when they respond "Cochinadas" or "Púchilas". Expressing the sexual act in phrases of popular invention such as "Cositas" or "Cuchicuchi", implies anyway hiding and keeping these human relations invisible. The fact that 20% of the EG-E respond with expressions such as "Love each other" and "Make love", can be pointed out as statistical evidence that is somewhat significant in the impact of the PSIF and that there was a cognitive change in this regard.

As regards the birth of people, the EG-E in the test and the GC-E in the two surveys give evasive answers or answers of direct ignorance. The majority options are: "It's not said", "It's not said anything", "I was taken out of my belly" and "Doesn't know/No answer mom/dad". In the retest, the GE-E the totality of the answers: "Because of Mommy's vagina", "They cut out my mommy's belly" and "Because of the belly", give an account of a more precise language. It is assumed that this is a product of better communication by the parents who participated in the PSIF.

Regarding the process of fertilization, the EG-E in the test does not give any answer that can be considered adequate or correct. In the retest, the majority of this group of students refines the answers considerably: "The father puts the baby in, he puts the sperm in the belly", "When they make love, the father puts the seed in", "For the seed that my daddy puts in", "For the vagina they go in, the father puts the seed in". In the GC-E in general, the answers in the two surveys are inaccurate and inappropriate. A more accurate conceptual handling is evident in the EG-E after his parents.

6. Conclusions

The general objective was to verify if through a formative process the ways in which parents seek formation and information on sexuality for their sons and daughters change. The final conclusion is that, through an appropriate educational programme, the knowledge, beliefs and attitudes of parents change. It provides tools and strategies to build an enriching sexuality in children. These elements are materialized in different aspects that constitute the specific objectives.

In relation to the specific objective: "Investigate the use of language applied by parents on child sexuality", it is concluded that the majority of the parents surveyed use terms and phrases that are different from those established in the Spanish language. The use of these expressions in everyday life is due to the insecurity that parents have regarding their

knowledge of sexuality. This topic is still considered a taboo subject in society. In that sense, the vocabulary tends to be hidden in a popular, folkloric language, separated from science.

With regard to the specific objective "To know the mother and father strategies used by mothers and fathers for sex education of children", there are two groups of conclusions: 1) those applied by mothers and fathers for sex education of children in the experimental group before the FIP and the control group before and after the surveys, and 2) those applied by the experimental group after the FIP.

Within the strategies of the first group, it is concluded:

On various issues of sexuality, the student body responded in an incorrect or inappropriate way. This is the effect of the evasions or indirect responses that their parents give to their precise concerns.

Prohibiting the discussion of sexuality or related situations is a common way of hiding information. It encourages a distortion of childhood sexuality by the absolute majority of parents.

When avoidance and prohibitions are insufficient, physical or intellectual repression is the direct strategy of imposing silence or fear around the topics of sexuality by the parent in the home. Comparisons or similarities of human sexual organs with objects or animals in the environment are a pseudo-educational way of instilling sexuality.

Within the strategies of the second group, of those who participated in the FIP, there are several transformations. It is concluded that parents applied, during and after the process, dialogue as a timely and direct way of addressing children's concerns about sexuality. They implemented moments of conversation on their own initiative and not only in a reactive way to children's curiosity. There is reflection in terms of an enriching two-way communication, of mutual learning and health. This strategy is their new way of taking on information and sexual education with their offspring during the process of participation in the FIP.

A more precise conceptual management is evident in the students, sons and daughters of the parents who participated in the PSIF. The clarity and concreteness of the responses are two of the essential characteristics of the communicative interrelationship that the experimental group assumes as fundamental in the process of teaching and learning about sexuality in the family setting.

One of the research objectives is to "describe the knowledge, beliefs and attitudes about sexuality held by young children". Those who participated in the programme state that it is necessary for adults to intervene in the education and comprehensive development of children's sexuality. The training process determines that sexuality is considered a social construction and that these learnings can be motivating for children.

The self-perception of their own communicative abilities changes radically in the group of parents after their participation in the FIP. The control group maintains its original ideas. The experimental group looks for appropriate answers if they do not know them. It is predisposed to understand ideological positions that exist in this matter and to exchange information and knowledge even within its family or community environment.

The FIPP as a re-learning program allows for a change in attitude towards heterosexuality as a social norm. The experimental group demonstrates a tolerant and inclusive attitude

that breaks with the imposed ideological-educational structure. In this line, they agree that masturbation or physical touching of the genitals by girls and boys is part of a healthy construction of child sexuality.

Three topics are placed in prospective for future research from this work. The first is to characterize the way in which gender is constructed at the initial ages of the human being. The second is to determine the influence of religion on aspects such as sexuality or others that have to do with the education of children and young people. The third is to define the construction of child sexuality with broader and more socially, economically and culturally different populations. These issues with multidisciplinary teams that address the phenomenon of early human sexuality from different perspectives.

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Authors

MARTHA QUIROLA-LARREA obtained her Bachelor's degree in Education Sciences, with a mention in Kindergarten Teaching at the Central University of Ecuador, in 2015. She is studying for a Masters Degree in Early Childhood Education at the same university.

She is currently a tenured teacher at the Aurelio Chiriboga School of Basic Education.

CECILIA JARAMILLO-JARAMILLO obtained her Bachelor's degree in Educational Sciences, specializing in Philosophy, Social and Economic Sciences and a Master's degree in Higher Education at the Central University of Ecuador. Course on Gender, Development and Human Rights.

She currently teaches at the Central University of Ecuador, Faculty of Philosophy, Literature and Educational Sciences - Career in History and Social Sciences Pedagogy - Master's programmes.

Registro de títulos académicos mediante una aplicación basada en Blockchain y Smart Contracts

Recordkeeping of academic degrees through an application based on Blockchain and Smart Contracts

Luis Rosero-Correa

Universidad Central del Ecuador, Quito, Ecuador

erosero@golden-companies.com

https://orcid.org/0000-0001-7938-768X

Mario Morales-Morales

Universidad Central del Ecuador, Quito, Ecuador

mmoralesm@uce.edu.ec

https://orcid.org/0000-0002-7493-8072

Santiago Morales-Cardoso

Universidad Central del Ecuador, Quito, Ecuador

smorales@uce.edu.ec

http://orcid.org/0000-0002-3833-9654

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Resumen

La implementación de nuevas tecnologías en cualquier tipo de institución surge de la necesidad de generar mejoras en los procesos que éstas realizan con el fin de ofrecer mejores productos y servicios. En este artículo se analiza la propuesta de factibilidad de una

aplicación basada en la tecnología B*lockchain* y en los contratos inteligentes para reproducir el proceso de asignar títulos académicos a estudiantes sin necesidad de un ente central, terceras personas y procesos burocráticos mientras se aprovecha las características de estas tecnologías como la transparencia, la seguridad y la inmutabilidad. Así, se desarrolló dos contratos inteligentes complementarios entre sí aprovechando las características que existen actualmente para crear estructuras que representan objetos de la vida real y funciones que manejen estas estructuras como parámetros. Estos contratos se ejecutaron en un entorno virtualizado el que se simuló una cadena de bloques de *Ethereum* con el conjunto de herramientas de *Truffle*. Se evaluó los contratos inteligentes ingresando datos de prueba y con estos registros almacenados en la cadena de bloques se ejecutó el proceso de asignar los títulos académicos a los estudiantes a través de una función dentro del contrato inteligente principal. Para validar que el proceso se ejecutó correctamente, se realizó consultas a la cadena de bloques y se verificó que los registros de asignaciones de títulos se generaron y almacenaron en la cadena de bloques con éxito. De esta manera se pudo concluir que es factible el modelo propuesto basado en tecnología *blockchain* y contratos inteligentes

Palabras clave

Aplicaciones descentralizadas, *blockchain,* contratos inteligentes, *Ethereum,* títulos académicos.

Abstract

The implementation of new technologies in any type of institution arises from the need to generate improvements in the processes they execute in order to offer better products and services. This article analyzes the feasibility proposal of an application based on Blockchain technology and smart contracts to execute the process of assigning academic degrees to students without the need for a central entity, third parties and bureaucratic processes while taking advantage of the characteristics of these technologies such as transparency, security and immutability. Thus, two complementary smart contracts were developed, taking advantage of the features that currently exist to create structures that represent real-life objects and functions that handle these structures as parameters. These contracts were executed in a virtualized environment in which an Ethereum blockchain was simulated with the Truffle toolset. Smart contracts were evaluated by entering test data and with these records stored in the blockchain, the process of assigning academic titles to students through a function within the main smart contract was executed. To validate that the process ran successfully, the blockchain was queried, and it was verified that the title assignment records were successfully generated and stored on the blockchain. In this way, it was possible to conclude that the proposed model based on blockchain technology and smart contracts is feasible.

Keywords

Academic degrees, Blockchain, decentralized applications, Ethereum, smart contracts.

1. Introduction

This study summarizes the most important components that were fully developed in the thesis work of Rosero-Correa 2019. The emergence of new technologies tends to generate an impact on society (BBVA Research, 2016, p. 14). This impact can be on a greater or lesser

scale depending on the functionalities and usefulness that the technology offers. Taking these aspects into account, it is possible to understand why some innovations tend to go unnoticed while others are very well received, such as the case of Blockchain, which was born in 2008. and according to Antonopoulos (2017) "it is a technology based on two main pillars, the first, cryptographic algorithms to encrypt data and the second, distributed computing to support the processing of large amounts of information" (p. 22) and thanks A great variety of applications have been generated due to its versatility, as indicated by the examples in Gómez et al (2017) in which "logistics and transportation, property records and the internet of things" are mentioned (p. 6) without forgetting of course cryptocurrencies.

Later to give greater acceptance and enhancement to Blockchain appears the Ethereum project which from the perspective of Buterin can be understood as an alternative protocol that facilitates the construction of decentralized applications (Buterin, 2009, p. 13) thanks to the birth of another concept known as intelligent contracts that in the book Matering Ethereum one of the definitions says that intelligent contracts "are immutable software that are executed in a deterministic way in the context of a Virtual Machine Ethereum as part of the network protocol Ethereum" (Antonopoulos & Wood, 2018, p. 127). These programs are capable of managing assets that are included in such network and one of the most important characteristics is that for all this to happen, the participation of a mediator is not required since, as Mendoza-Tello (2018) "explains, the verification of the validity of the transactions is distributed among all the nodes that make up the Ethereum network, thus guaranteeing the security and integrity of these since they are organized within immutable blocks" (p. 6).

These advantages and characteristics that have allowed Blockchain and the intelligent contracts to begin to be part of various areas have also led them to venture into the academic arena as mentioned by Arenas & Fernandez (2018) when he proposed Blockchain to be used as "a transparent and reliable system to secure, share and verify academic credentials" (p. 2) in order to have a free and immutable repository of documents that have been issued by an academic institution so that they can be consulted by people interested in verifying the validity of such documents.

Taking these ideas as a premise, the present research work consists of analyzing the feasibility of making use of Blockchain's technology on the Ethereum's platform and the intelligent contracts to take advantage of its characteristics such as transparency, security, immutability, decentralization and inherent tools such as cryptography in order to execute the procedure of registration of academic titles in such a way that these are stored in this immutable registry that allows the verification of their originality and validity by people interested in these aspects.

The idea of carrying out this work arises with the intention of providing an alternative way to carry out the registration of academic titles in educational institutions. This is in order to speed up the registration process, automate it, avoid dependence on a central entity and omit bureaucratic processes that usually take a lot of time and cause difficulties for students, teachers and administrative staff. Consequently, the objectives of this work are: i) to develop a proposal for an application based on blockchain technology for the registration of titles, ii) to verify the feasibility of the current tools allowing the development and deployment of intelligent contracts iii) to follow an experimental methodology for the development of intelligent contracts proposed by the authors and to test their validity.

Since the development and execution of intelligent contracts requires a chain of Ethereum blocks and since the process of creating a private chain of blocks is too complex for what is intended to be tested, the tools provided by Truffle will be used as an alternative. These tools allow, among other things, the simulation of a chain of Ethereum blocks in which the intelligent contracts are to be executed and the respective tests to be performed.

With these considerations, the work has been structured in such a way that at the beginning the state of the art is presented, showing the different areas in which the block chain and intelligent contracts have been successfully applied. After that, a section of preliminaries is presented, in which some of the most important topics on which the work is developed are dealt with, in order to generate the bases that allow understanding the general context of what is desired to be done. Next, the development of the proposal is presented where the main points that will conform the structure of the intelligent contracts that are going to be developed are explained, as well as the execution in the chain of blocks, and finally the conclusions obtained are presented.

2. State of play

Due to the great advantages and characteristics offered by both the block chain and intelligent contracts, there have been several scenarios in which they have appeared in recent years and continue to extend increasingly to new fields where innovation gives way to new applications; among the most common are the following:

2.1 Supply chain management

Al hablar de cadena de suministro se debe considerar dos puntos fundamentales, el primero consiste en todo el proceso al que se refiere en si la cadena de suministro para pasar desde la materia prima hasta los productos elaborados que se venden al por menor; el segundo consiste en garantizar que esos productos estén siempre disponibles para los consumidores y que sean de calidad generando de esta manera confianza en los compradores y prestigio para el producto y la marca.

Las aplicaciones de Blockchain en la cadena de suministro tienen muy buena acogida, ya que como se menciona en la revista de Microsoft (2018) gracias a Blockchain "las organizaciones rastrear los productos desde la franja de tierra donde crecen hasta la entrega al por menor" (p. 5). El poder generar registros de todo cuanto sucede en el trayecto de los productos hasta el consumidor final incrementaría la confianza y aceptación porque como explica Galvez de esta manera se estaría otorgando la capacidad de que los consumidores puedan acceder a la historia completa de los productos que adquieren (Galvez 2018, p. 230). Aunque si bien la completa aceptación de blockchain como una herramienta para el mejoramiento de la seguridad y las prácticas de la cadena de suministro puede tomar algún tiempo, este beneficio está siendo respaldado por varias historias de éxito como es caso de Skuchain que Bermingham en el sitio web Global Trade Review describe como una compañía estadounidense que se ha aliado con la empresa japonesa NTT Data con la finalidad de construir una plataforma basada en blockchain para la cadena de suministro y gestión logística (Bermingham, 2018).

2.2 The Internet of Things (IoT)

One term that's been causing a stir lately is the Internet of Things. Although the Internet of things is not in itself a new technology, it has generated a great impact on society because of its usefulness in a wide variety of fields. Currently, research continues on how to broaden

its horizons and expand it further because, as Reyna (2018) mentions, "the internet of things seeks a totally connected world, where things can exchange data and interact with each other so that the real world can be represented digitally" (p. 173). At the moment having an interconnected world generating and exchanging huge amounts of data is solved, but this sharing of data between heterogeneous devices needs certain aspects such as a high level of security, and it is at this point where the chain of blocks comes into play because as Hammi (2018) explains "the internet of things is provided with aspects such as integrity, availability, scalability, non-repudiation which refers to the ability to ensure that an entity or in this case a device cannot deny having performed a certain action, as well as identification and mutual authentication" (p. 130), and is corroborated by Makhdoom (2018) mentioning that 'Blockchain with its decentralised architecture and key benefits provides an ideal solution for Internet of Things systems especially in an unreliable environment' (p. 260).

The enormous potential of the Internet of Things combined properly with the blockchain proposes the formation of robust and reliable systems in which one can have a record of everything that happens in the environments one is controlling thanks to the support of the Internet of Things devices. In this sense, Christidis (2016) gives us the guideline of "using these robust systems within the factories, in such a way that processes are automated and user interaction is reduced" (p. 7) while having a shared database with which processes can be tracked thanks to the updates coming from the Internet of Things devices that are automatically propagated throughout the network. A clear example of the combination of the block chain with the Internet of Things can be the case mentioned above of Skuchain who as explained by Bermingham (2018) "seeks to control the supply chain and logistics management by combining the block chain and the Internet of Things based on radio frequency (RDIF)" (p. 2).

2.3 Distributed energy systems

In the present times, by the advance to giant steps of the technology and the easy access to the information, it has been obtained that for the people it is a little simpler the investigation and creation of their own products, such it is the case that the people have begun to create their own alternative sources of energy, partly to have a sustenance before a general electrical failure and to be more autonomous and not to depend so much on the public services, reducing their consumption and the amounts that are paid for the service. But this autonomous generation of energy has been so productive that some of those who do so have even generated surpluses, so that apart from disengaging from the public service of energy have found a new business model giving way to distributed systems of energy, which according to Kumar refer to generation in a decentralized manner, thus improving the overall efficiency of systems in terms of power generation, economy and environment (Kumar, 2018, p. 5).

Within this whole idea of generating electricity in an autonomous and decentralized way, Blockchain appears, which as Andoni (2019) indicates "due to their nature, blockchains could provide a promising solution to control and manage complex energy systems and increasingly decentralized microgrids" (p. 151). On the assumption that this surplus energy can be traded through platforms on a peer-to-peer basis, which is what the block chain provides where no third parties or intermediaries are involved, it would only remain to agree on how this trading will take place, and as proposed by Mylrea (2017) this can be controlled through smart contracts, since 'they facilitate exchanges of energy between peers

by allowing producers and consumers to sell this energy to each other, rather than transacting through a multi-tier system' (p. 17).

An example of the application of the block chain in distributed energy systems is the Power Ledger which is a platform developed to manage the exchange of energy between peers and which runs on Blockchain technology.

3. Preliminaries

3.1 Block chain

As a first idea Galvez (2018), among other things, mentions that "the blockchain is essentially a distributed database that stores records in the form of encrypted blocks that can be verified at any time in the future" (p. 222), and it is for this reason that this technology takes the name of blockchain or Blockchain, since a set of data is gathered in an encrypted manner in a structure that is called a block, which in turn is related to the predecessor blocks in the form of a chain. Another way of looking at the blockchain that is simpler and more intuitive is presented by Crosby (2015), who says that "the blockchain can be viewed as a public ledger of all the digital transactions or events that have been executed and shared among the participating parties within a Blockchain network" (p. 3).

To better understand what the blockchain is, it is important to know that the blocks are the fundamental unit of this chain and are composed of a set of transactions, which as Singh (2018) explains, "were performed in a given period of time" (p. 220), but these blocks by themselves do not represent much but require a link that unites them, which is called the chain and this is achieved according to what is stated by Makhdoom (2018) who says that "the blocks are formed in such a way that each new block is cryptographically connected to the previous block" (p. 255), thus achieving the symbolic link that makes these blocks form a single sequential group inseparable as a chain.

Within the blocks, when observed in a somewhat more technical way as Grewal-Carr (2016) does, two important parts can be noted (p. 5):

> The header, which includes metadata such as, a unique block reference number, the time the block was created, and a link to the previous block
>
> The content, usually a validated list of digital assets and statements of instructions, such as the transactions performed, their amounts, and the addresses of the parties to those transactions (p. 5).

Once these aspects of how the block chain is formed have been defined, two perspectives can be glimpsed. The first one is clear to see since each block has information and this takes up disk space, therefore, as more blocks are added to the chain, disk storage will also increase; the second one, which is a little more complicated to understand although it presents a more encouraging perspective, is the one indicated by Singh (2018) and expresses that "the more data the block chain has, the stronger it becomes" (p. 220).

3.1.1 Block Chain Architecture

The chain of blocks breaks the paradigm of a central server that governs the network providing with that the characteristic of decentralization, for this reason, Min (2018) explains that:

> Since the architecture on which a block chain is based is a decentralized mesh network of computers, connected together instead of a single central server, there are a number of layers that govern block chain operations and create the protocols for Blockchain technology applications (p. 3).

These layers can be understood as modules of the architecture, and then after an analysis the layers that make up the block chain architecture are detailed (Min, 2018, p. 3).

The first module corresponds to the data source module that Min describes as the basis for creating a block chain in which the database is distributed, since it is not based on a client-server architecture, and it does not require users to identify themselves in order to validate credentials that can be manipulated or altered. In a second layer is the transaction module which is in charge of validating and creating new transactions, first creating an agreement between the two parties involved and then sending the transaction to the network to be validated by the miners. The third layer corresponds to the block creation module, which is in charge of adding to the chain the new block that has been mined so that each new block is located followed by the previous one and linked to it. In the fourth layer is the consensus module that is in charge of verifying that the transactions are valid by means of a consensus algorithm, thus avoiding the manipulation or corruption of the data. Finally there is the connection and interface module, this module is in charge of providing web interfaces between the users at the same time that it allows to know the real time status of the block chain and the transactions (Min, 2018, pp. 3-5).

3.1.2 Merkle trees

As mentioned above, blocks basically consist of two parts, the header and the body which contains the transactions, but in order for these not to be altered and to be secure within the block they are encrypted in a recursive manner through a multi-level data structure known as the Merkle tree. The transactions are assembled in these blocks in such a way that each consequent block is connected to the previous block via a hash value.

A Merkle tree, also known as a binary hash tree, as defined by Antonopoulos (2017) "is a data structure used to efficiently summarize and verify the integrity of large data sets" (p. 284). The structure of this tree as shown in Figure 1 and as explained by Buterin (2009):

> It consists of a set of nodes with a large number of leaf nodes at the bottom of the tree containing the underlying data, a set of intermediate nodes where each node is the hash of its two children, and finally a single root node, also formed from the hash of its two children, representing the 'top' of the tree" (p. 9)..
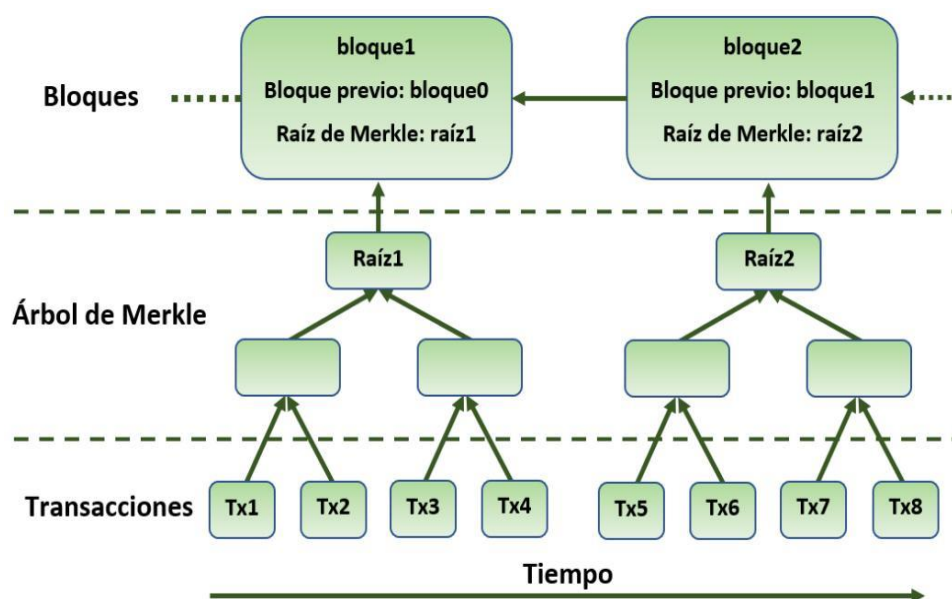
Figure 1. Diagram of a block chain, formed from transactions in a Merkle tree structure
(Antonopoulos, 2017, p. 429)

To form the Merkle root, we start from the set of transactions, obtain the hash value of each one and group them in pairs, so that in the next step the hash of the pair is calculated and the process is repeated until only one node is left. If the set of transactions results in an odd number, the strategy is to double the hash value of one of the transactions to follow the recursive process and get the Merkle root.

3,1.3 Hash Functions

The hash cryptographic functions are an important element of the block chain since they are used at the time of building the blocks through the Merkle tree structure. A hash function is basically a function that transforms any message of variable length into a set of characters of fixed length, regardless of the length of the input data.

Hash functions are used in many cryptographic algorithms and protocols of which there are a wide variety of applications in the area of information security and currently hash functions are of paramount importance in applications where efficiency is required to implement integrity verification and authentication as is the case of applications based on Blockchain. Among the most common algorithms in which hash functions are used Medina (2016) mentions that are among others the SHA-256, which actually comes from SHA-1, RIPEMD, BLAKE, Skein (p. 5).

Hash functions are also widely used in cryptography and as an example we can take Alvarez's one that in his work explains how the Advanced Encryption Standard or AES can be used as a pseudo random number generator to serve as a basis for password hash functions which are very useful to encrypt user passwords that are usually of variable length and cannot be used directly as fixed size encryption keys (Alvarez et al., 2018, p. 1).

3.1.4 Consensus protocols

One of the characteristics of Blockchain is that within the whole network there is no central node in charge of orchestrating and managing the other nodes or the information that each

of them stores in its copy of the block chain or otherwise seen in the block chain, there is no central node that ensures that the ledgers in all distributed nodes are all the same, moreover as Zheng et al. (2017) explains "the nodes do not need to rely on other nodes so some protocols are necessary to ensure that the records in different nodes are consistent" (p. 358). The idea is that in a distributed network where the participants are unknown and unreliable, transactions can be verified through consensus, this consensus being the mechanism or set of rules that allows all the nodes to agree on the order of transactions.

Many consensus algorithms exist and Andoni describes many of these in his work on Blockchain in the energy sector (Andoni et al., 2019, pp. 148-150). The three most important ones are presented below:

- Proof of Work (PoW): Proof of work is an algorithm that consists of solving a computationally intensive and complex task in order to add a block to the chain. More specifically, this algorithm must calculate a hash value for the block header, so that as explained by Makhdoom (2018) "this computed cryptographic hash must have a specific number of zeros at the beginning, according to what has been defined in the difficulty level" (p. 258). When a node obtains the target value it transmits the block to the other nodes in the network and these must mutually confirm the accuracy of the hash value, so if the block is validated the other nodes must add it to their local copy of Blockchain and as a reward for the computational work done for the calculation of the hash value the node that solved the task is rewarded.

- Proof of Stake (PoS): This consensus mechanism, instead of the node declaring the result, is the system that chooses a network node to calculate it, through what Singh (2018) calls "a lottery system" (p. 220) in which the nodes that have more "capital" in crypto coins are taken into account, so the more coins a node has, the more likely it is to be chosen to calculate the hash value of the next node to be added to the string. This mechanism has two advantages, the first one is that it improves the latency, the large amounts of calculation and the high energy consumption that are typical of the working test consensus mechanism, the second one refers to the fact that there is less possibility that the block chain suffers an attack because at least 51% of processing capacity would be required to achieve a successful attack. This idea is based, as mentioned by Zheng (2017), on the fact that "people who own more coins are believed to have less interest in attacking the network" (p. 560).

- Practical Byzantine fault-tolerance algorithm (PBFT): This mechanism is designed to resolve conflicts between participating computer nodes in a distributed network, when one set of nodes generates a different output than the others. As mentioned by Andoni (2019), this algorithm "requires at least 2/3 of the network to behave honestly and message overload can increase significantly as the size of the network increases, affecting both speed and scalability" (p. 150), which means that this mechanism can tolerate up to 33% of malicious nodes to remain consistent and secure. Despite being more efficient than other protocols, it is considered expensive because of the number of messages that are necessary to achieve consensus, since as Liang (2012) explains "each and every node is required to send its results using its own internal state and information available to it" (p. 4). According to Zheng (2017), the entire process for achieving consensus through these messages "could be divided into three phases: pre-preparation, preparation and commitment" (p. 560).

3.2 Intelligent contracts

In recent years, Blockchain's ability to run stand-alone scripts has been exploited, whereby developers have created new versions of the blockchain that can perform arbitrary calculations other than the transfer of coins. This is how the Smart Contracts were born, which as Xu (2016) indicates "were introduced as stand-alone programs that run throughout the Blockchain network and can express triggers, conditions and business logic to allow for complicated programmable transactions" (p. 1).

Taking into account that intelligent contracts can be a complete program stored in a blockchain platform and distributed over all the nodes of the network. In order for this contract to exist within the network, Destefanis must proceed, as indicated, to store the intelligent contract in the block chain by means of a contract creation transaction, to which an address is assigned to identify it, which is generated as long as the creation transaction has been successfully executed (Destefanis et al., 2018, p. 21). Once these contracts are executed over the block chain they are responsible for managing the assets that such a platform includes through transactions that go beyond simple currency purchase/sale transactions, and may have more extensive instructions built into them all without depending, as Gürkaynak (2018) explains, "on an intermediary party, such as a bank or government agency, for value transfers, while providing the parties involved in the transaction with absolute confidence in the validity and security of the transaction" (p. 848).

3.2.1 Structuring of intelligent contracts

As shown in Figure 2, an intelligent contract basically consists of an account balance in virtual currencies in this case Ether which is the Ethereum's cryptomoney, a private storage and an executable code. This code when stored by a transaction as mentioned by Luu (2016) "is a 'standalone agent' stored in the block chain, coded as part of the 'creation' transaction that introduces the contract in the block chain" (p. 256), is for this reason that it is identified by assigning a unique address of 20 bytes and once introduced in the block chain can not be modified.
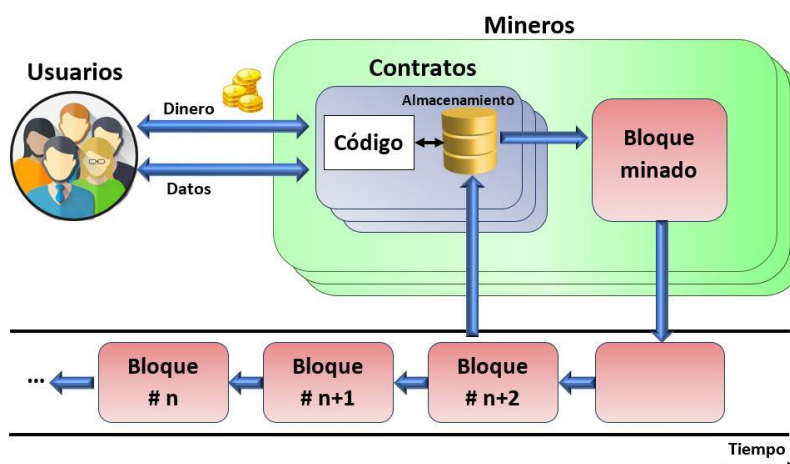

Figure 2. Structure of the elements that make up an intelligent contract (Alharby y Moorsel, 2017).

The additional step required for the contract to be inserted in the block chain is for the creation transaction to be within the set of transactions that will make up the Merkle tree and to be added to the block that is to be mined and included in the block chain.

3.2.2 Smart contracts work

Generally speaking, transactions sent to an intelligent contract go through three phases, the first being the inputs, the second corresponding to the contract interpreter and the last being the outputs as shown in Figure 3 and detailed below.

- **Entries:** in this phase you specify the contract identifier, the transaction request, any dependencies that may exist and the current status of the general ledger**.**
- **Contract Interpreter:** This phase is loaded with the current general ledger status and the intelligent contract code. These transactions are processed according to the procedure outlined in Hyperlerger magazine (2018) which states that "when the contract interpreter receives a request, it immediately checks it and then rejects any invalid request" (p. 4). The contract can, depending on the transaction it receives, read/write to your private storage, store money in your account balance, send/receive messages or money from users/other contracts or even create new contracts.
- **Outputs:** if the request is valid, outputs are generated including, a new status and any side effects. When all processing is complete, the interpreter packs the new status, a correction statement and any order suggestions required for the consensus services. That package is sent to the consensus service for final engagement with the block chain..
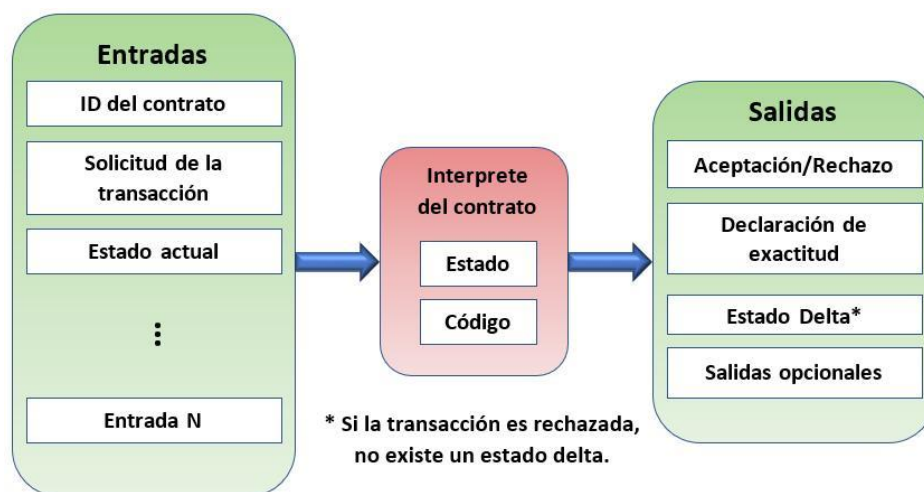
Figure 3. Phases to be followed for the execution of an intelligent contract (Buterin, 2009)

The state that the contract has at the moment of receiving a transaction will change to a delta state in case the transaction is executed correctly, if the transaction request is not validated, the contract code will not be executed and therefore a delta state cannot exist since the current state has not been altered.

3.3 Ethereum

Ethereum was conceived at a time when people recognized the power of the Bitcoin model and were trying to go beyond the applications of cryptomontages. That's how the young programmer Vitalik Buterin, who had a certain passion for Boitcoin, brought Ethereum to life after spending a series of stages beginning in 2013 when he began to think about how to expand the capabilities of Bitcoin and Mastercoin by proposing in October of that year a more general approach in which he conceived more flexible contracts with which to replace

the language of the specialized Mastercoin contract. Thus by December he began to share a technical document describing the central idea behind Ethereum which consisted, as Antonopoulos (2018) mentions, "in a chain of blocks that is complete and general-purpose Turing" (p. 41).

This platform is different from the previous Blockchain systems and besides being the leading Blockchain protocol in terms of innovation it is known, as explained by Dika (2017), "as the world's computer and as the future of the Internet with block chain technology" (p. 8). This is due to its novel idea of distributed computational processing of applications without the intervention of third parties and the predominance of transparency, it can also be mentioned that it is an open source platform which represents a cultural change from some of its predecessors.

The fact that Ethereum represents a chain of blocks with a complete Turing programming language built in, means that according to Vujičić (2018) "Ethereum supports all types of calculations, including loops and state transition, as well as other improvements to the structure of the chain of blocks" (p. 4). Within the Ethereum block chain, Ether (ETH) crypto-currency is handled to enable payment of financial transactions and processing of applications. Such applications as mentioned in the publication of coinpy.net (2018) "can be programmed in seven different languages including JavaScript, Go, Python and Lisp" (p. 3).

3.3.1 Ethereum Accounts
Within Ethereum as Buterin explains there are two types of accounts that can be seen as externally owned accounts to those that do not have contract code in their storage, and the other type of accounts are contract accounts, created specifically to execute the code of the intelligent contracts they host in their internal storage (Buterin, 2009, p. 13).

These accounts, as Buterin (2009) explains, are composed of four fields:

- The nonce, a counter that is used to ensure that each transaction can only be processed once.
- The current ether balance of the account.
- The contract code of the account, if any.
- The default empty account storage (p. 13).

Non-contract accounts also have their internal storage which will remain empty since it is intended to store the smart contract code, and since externally owned accounts do not handle contracts, they have nothing to store in their internal storage.

3.3.2 Messages and transactions
In Ethereum the concepts of messages and transactions are handled and as Buterin (2009) explains:

> The 'messages' in Ethereum have some similarity with the transactions in Bitcoin, although with three characteristics that differentiate them. The first is that an Ethereum message can be created by an external entity or by a contract, while a Bitcoin transaction can only be created externally. The second is that there is an explicit option for Ethereum messages to contain data. And the last is that the recipient of an Ethereum message, if it is a contract account, has the option to return a response;

> this means that Ethereum messages also cover the concept of roles (p. 14).

These three features give Ethereum messages a clear advantage over Bitcoin transactions because, although these features make Ethereum messages more complex to manage, they also allow you to expand the areas in which you can apply them by allowing you to perform data transport and execute functions that use this data.

On the other hand, with respect to Buterin transactions (2009) it mentions that:

> The term 'transaction' is used in the Ethereum to refer to the signed data packet that stores a message to be sent from an externally owned account. Transactions contain the recipient of the message, a signature that identifies the sender, the amount of ether and the data to be sent, as well as two values called STARTGAS and GASPRICE (p. 14).

As mentioned by Buterin STARTGAS, it refers to the limit of the number of steps that are given to execute the requested code for a transaction in such a way that, if the transaction is not completed in the determined number of steps, it is interrupted and ends up reversing all the changes avoiding that the execution is carried out in an infinite way. As for the GASPRICE, this refers to the fee that must be paid to the miner for each computational step he takes to carry out the execution of the transaction (Buterin, 2009, p. 14).

Here the concept of gas comes into play, which as Ast (2018) mentions in his publication in Medium, "gas is the unit that measures the computational work required to execute transactions or intelligent contracts in the Ethereum's virtual machine" (p. 2). In other words, if during the execution the "balance" for executing transactions is terminated, all status changes will be reversed, except the payment of fees, and if the execution of the transaction is stopped with some gas remaining, the remaining part of the fees will be refunded to the sender.

3.3.3 Smart contracts in Ethereum

An intelligent contract from Buterin's perspective can be used to represent virtually any type of asset that can be digitized by writing the logic in a few lines of code within an intelligent contract (Buterin, 2009, p. 1). With this in mind, the contract code is written in a programming language accepted by the platform. Once the code is written, it is enough to load it in, enter the initial variables and send it to be processed and executed. For its execution, the contracts require firstly a special software called Ethereum Virtual Machine (EVM) that in turn runs in each of the nodes of the Ethereum network and secondly the transformation of the code to bytecode which is the language that understands the Ethereum Virtual Machine.

Since Ethereum allows users to load and execute code that represents the contracts, these can be simple or arbitrarily complicated, although it should be taken into account as mentioned by Kiffer (2017) that "each operation that the code executes, and each byte of memory that the code uses, costs 'gas'" (p. 95), that is, the more complex these contracts are, the more ether they will spend for their execution. At Ethereum the contracts also have their own balance of ether, and can even transfer ether and call other contracts, have their own storage, and have the ability to act as an external proprietary account at Ethereum.

4. Experimental methodology

The term methodology refers, according to Quecedo and Castaño (2002) "to the way we approach problems and seek answers, to the way we conduct research" (p. 7). This gives us the guideline that the methodology used to solve a problem can vary depending on how the problem is looked at and also on how the answers are proposed.

The methodology occupies an important place within the research process, so that for Rodríguez and Valldeorialo (2014) "the methodology is fundamental in any research process, since it determines the way in which the research is developed" (p. 31). Considering these aspects on the methodology, it has been decided to direct this investigation by means of the descriptive method, which, as indicates Pérez (2004) "is oriented towards the present and the levels in which it acts are the applied investigation and active investigation" (p. 91) which is precisely what is sought in this investigation.

Therefore, for the development of this article, the authors propose the methodology detailed below:

- **Determine the functionality of the intelligent contracts:** as a first point, it is required to establish exactly what our intelligent contracts are going to do, so that we can determine the resources and tools necessary for the development of the work.
- **Description of the required architecture:** the next step is to carry out a detailed analysis of the contract's functionalities to establish the requirements of the architecture and the working environment necessary to carry out the development, in order to have a clear idea that allows to prepare this working environment in an adequate way.
- **Selection of tools:** once the requirements for the development of the work are clear, the next step is to select a set of preferably free software tools that support the architecture and the whole environment specified by the requirements of the first phase.
- **Development of the intelligent contracts of the application:** with the architecture and the work environment ready, the creation of the intelligent contracts can continue, so this phase is focused on the creation of files and writing of code based on the following guidelines:
  - Manage a directory structure that allows you to maintain the order of the files according to their functionality
  - oUse words for file names that identify the purpose for which they were created and the functionality they serve within the project
  - o For the code of intelligent contracts, name the variables and functions in such a way that by reading them you can clearly understand what their purpose and function is within the contract.
- **Deployment of the intelligent contract:** the objective of this phase is to carry out the procedure for the deployment of intelligent contracts which consists of inserting these contracts in the block chain. At the same time, monitoring of transaction generation and block mining is carried out to verify that it has been deployed correctly. This helps to verify possible errors and to understand how the process works. Within this phase three important tasks are considered which are:

- o oDebugging, to verify that there are no errors or inconsistencies within the written code in order to prevent the contract from being executed incorrectly or producing unexpected results.
- o oCompilation, to convert the source code into the binary that is required to execute the intelligent contract.
- o oDeployment, which involves sending the compiled Smart Contract code to the network so that it is available to users and can be executed in the Ethereum virtual machine.

- **Interaction with the intelligent contract:** this phase aims to interact with the intelligent contracts by calling the functions that make them up. In this way, data will be recorded and consulted while monitoring is carried out at the same time. Firstly, the outputs produced by the execution of the functions are verified and secondly the generation of transactions and the mining of blocks to add them to the block chain.

5. Proposal development.

5.1 Smart contracts in the registration of academic titles

5.1The idea of using the chain of blocks and smart contracts in the process of registering academic degrees is to provide a reliable and secure way to verify the existence and authenticity of the degree a person has earned. So that, when you look at this information, you can be sure that it is true and has not been altered by knowing that it is stored in an immutable record such as the chain of blocks.

As intelligent contracts are self-executing and automatically implement the terms of the agreement between two parties, they allow for the streamlining of processes by providing, as Toyoda (2017) mentions, "the ability to identify forgeries if any inconsistency is found in the process" (p. 2). This feature will prevent the registration of undue titles and will guarantee that the titles assigned to persons are real and cannot be modified due to the difficulty of doing so because of the logic with which the blocks in the chain are generated, in which each one is cryptographically linked to the previous one.

The main advantage of registering academic titles through intelligent contracts based on the block chain is that this covers a large number of additional characteristics such as immutability, transparency, security and decentralization. This set of features changes the perspective of the way this activity is carried out today and makes it possible to be part of a technology that augurs well for the future. What is currently most welcome are the decentralized systems and the generation of trust between unknown entities through the use of tools such as cryptography.

5.2 Development of the intelligent contract

Figure 4 shows the general outline of the process to be followed for the elaboration of the intelligent contract, which ranges from codification to deployment in a private block chain by making use of the set of tools offered by Truffle.
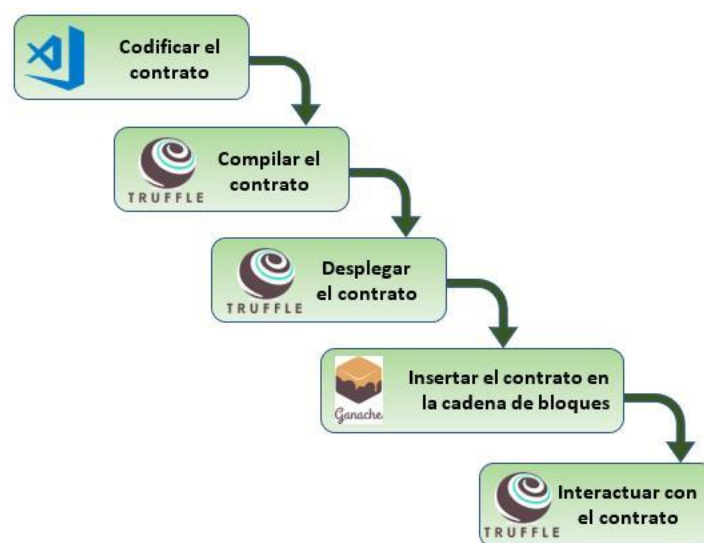
Figure 4. Diagram of the phases for the development of an intelligent contract from codification to deployment

For the development we used open source tools such as Visual Studio Code (VSC) which was used to write the code that, despite being a Microsoft product is free. Likewise, the applications of Truffle's toolkit are all open source so they can be used without the need for licenses.

5.2.1 Defining the Intelligent Contract for Securities Management

5.2.1.1 Defining the compiler versionr

In order for the intelligent contract code to be executed it must be compiled and as Antonopoulos and Wood (2018) state "the command line compiler for solidity is solc" (p. 134). This compiler allows to convert, as Antonopoulos mentions, the solidity code into binaries transformed in turn into hexadecimals which is what he understands and will be executed in the Ethereum virtual machine (Antonopoulos & Wood, 2018, p. 134). For this reason, any intelligent contract must be started by indicating the compiler version that you are going to use, this is done in order to avoid that future compiler versions may introduce incompatible changes at the time of compilation. At the time of this work the last stable version of the compiler is v0.5.2 but we have chosen to use the experimental version ABIEncoderV2.

5.2.1.2 Declare the contract

For the declaration of the contract, the word reserved contract is used which, as Antonopoulos (2018) states, "is similar to a class declaration in other object-oriented languages" (p. 28). The word contract is followed by the name of the contract file, which is conventionally named using the CamelCase structure. Finally Antonopoulos and Wood mention that it opens and closes keys within which all the contract logic will be written, thus defining the contract itself and its scope as it happens in several programming languages (Antonopoulos & Wood, 2018, p. 28).

5.2.1.3 Declare state variables

A smart contract according to Ethereum (2017) "is a collection of code (its functions and data (its status) that reside at a specific address in the Ethereum Blockchain" (2017, p. 13). For state variables in this case, an address variable is handled to assign the address of who

deployed the contract. The remaining three variables of the mapping type allow you to relate an address to a list of data of type Title, StudentDegree and Student respectively, in which records of these data structures will be stored.

5.2.1.4 Declaring the contract constructor

The intelligent contract constructor is a function that is executed only once when it is instantiated and as mentioned by Antonopoulos and Wood the way the constructor is written depends on the compiler version being used, so it can be written as a function with the same contract name (for compiler versions up to 0.4.21) or with the reserved word constructor (for versions from 0.4.21 and above) (Antonopoulos & Wood, 2018, p. 143).

Within the declaration it is indicated which actions will be performed to initialize the contract, in our case we will indicate that the owner state variable will be assigned the address of the person who created the contract.

5.2.1.5 Defining Data Structures

Data structures or structs according to Ethereum are more complex data types that are used to represent real-life objects and are formed by grouping together several variables of primitive data types (Ethereum, 2017, p. 23). These structures allow you to extend the functionality of intelligent contracts by handling custom and more complex data types, as they can include not only primitive data types but other structures.

For the creation of the contract, according to the authors' criteria, three data structures were defined to manage each of the objects that are part of the registration process of academic titles. These structures are described below:

1. The data structure Title containing three fields: a string type identifier, a string type name, and an unsigned integer that will store the timestamp on which a title is created.
2. The Student data structure containing four fields: the string ID, the student name, the unsigned integer timestamp and the title boolean to indicate if the student has been assigned a title.
3. The StudentTitle data structure containing five fields: the name of the reviewer of type string, the grade with which the title of type uint or unsigned integer is recorded, the timestamp in which it is created of type unsigned integer, the student of type Student defined by a struct and the title of type Title defined by a struct.

5.2.1.6 Defining function modifiers

Function modifiers as explained by Ethereum (2017) "are a convenient way to validate function inputs" (p. 29). These modifiers constitute a property that allows changing the behavior of the functions within the contract. The most common way to use them is to check the fulfillment of a condition before executing the function. For our contract, we have created a modifier that checks and forces the owner of the contract, i.e. the one who created it, to be the only one who can execute the function to which this modifier applies..

5.2.1.7 Functions defined in the contract

For our contract we defined several functions classified as primary and secondary according to the task they perform within the contract as summarized in Table 1.1.

Identifier	Type	Description

RegisterNew Student	Main		Allows you to enter the registration of a new student by providing the name and ID
RegisterNewTitle	Main		Allows the entry of a new title record by providing the title identifier and name
RegisterStudentDegree	Main		Allows a student to register a degree by providing the name of the reviewer, the degree grade, the student's ID and the degree identifier.
check outStudents	Secondary		Searches the student register by providing the student's ID.
CheckTitles	Secondary		Performs a title registry search using the title identifier.
GetStudent	Secondary		Allows you to extract a student from the register by means of his/her ID.
GetTitle	Secondary		Allows to extract a title from the register by means of its identifier.
GetStudentList	Secondary		Allows to retrieve all the existing student records.
GetTitleList	Secondary		Allows to retrieve all the existing records of the titles.
GetStudentListDegrees	Secondary		Allows to retrieve all the existing records of the graduated students.

Table 1. Summary of contract functions Titles

5.2.2 Creating the intelligent contract for chain managemen

As in the previous case, the first thing to be defined in the contract is the version of the compiler to be used, followed by the definition of the contract and within this its respective functions, which are summarized in Table 2.

Identifier	Type	Description
compare()	Main	It allows the comparison of the two text strings by returning an integer response that indicates whether the strings transformed into bytes are equal or not.
equal()	Secondary	It is in charge of receiving the two string type parameters that you want to buy and then send them to be processed in the compare() function.

Table 2. Summary of the functions of the Stringutils contract

5.2.3 Define the migration files of the contracts

To deploy the intelligent contracts it is required to build a migration script which will allow the implementation of the contract and as indicated by Antonopoulos and Wood, one script can be created for each one, or a single script can be created to gather all the contracts so that they can be deployed sequentially (Antonopoulos & Wood, 2018, p. 241).

For the deployment of our contracts, a single migration file is used for the two generated contracts, Titulos and StringUtils. The structure of the script is quite simple, it consists of two variables of which each one refers to the file of the intelligent contract that is desired to deploy, then it makes use of the special object of node.js module.exports that will allow to expose the contracts as modules assigning to it the result of the deployment of the intelligent contracts, this in turn makes a call to the asynchronous function doDeploy() that receives as a parameter the object deployer that will allow to deploy the contracts and to link them since Titulos imports StringUtils to make use of its functions..

5.3 Smart contract deployment

In order to deploy the intelligent contracts, it is required to have a chain of Ethereum blocks, which as Antonopoulos and Wood suggest will be simulated locally, generating a private instance using the Ganache tool (Antonopoulos & Wood, 2018, p. 234). Figure 5 shows the result of the execution of the Ganache tool which will generate this private chain, in addition to 10 accounts with their respective addresses and 100 initial ethers that will be used to process the transactions.

One of the most important aspects of this tool is that as explained by Antonopoulos and Wood (2018) "it offers an Application Programming Interface and a set of Remote Procedure Call commands coded as Javascript Object Notation usually called JSON-RPC API" (p. 52). The Ganache tool, by default provides this interface at the localhost address and port by 7545, which is where you must connect to interact with the block chain. .
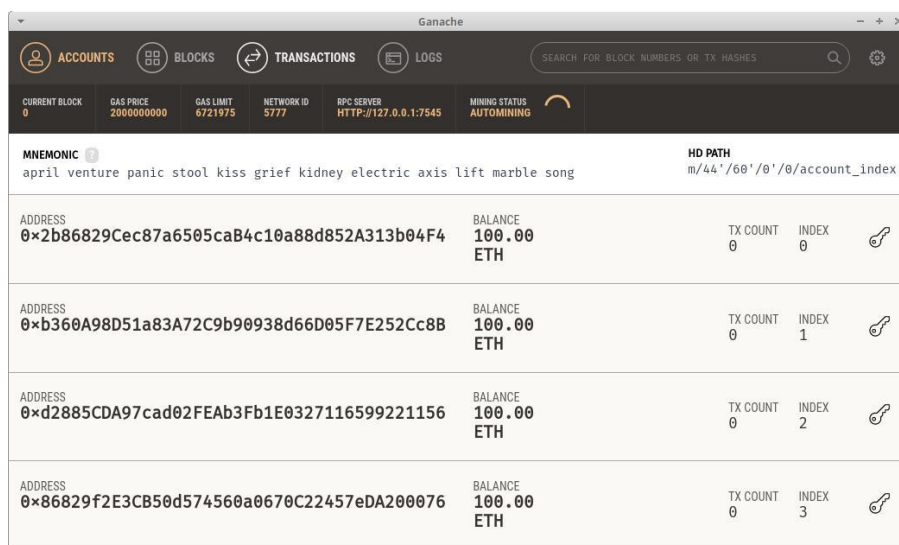
Figure 5. Screenshot of account generation in the Ganache tool

With the Ganache tool running and the RPC server up, the Truffle configuration file called truffle-config.js must be implemented in which the network of the block chain to be connected must be specified, i.e. the address of the server of the block chain provided by Ganache.

With all the code and configuration files generated and with the tools prepared, all that remains is to deploy the intelligent contract for which the Truffle tool will be used or more specifically the truffle migrate command which will execute all the migrations specified in the migration files which are generally located in the migrations directory and will in turn

generate a new directory in the project called builds in which there is a contracts directory containing a json file for each of the contracts in which there is information corresponding to the deployment of the contracts.

5.4 Interaction with the intelligent contract

Figure 6 shows the outline of the interaction process with the intelligent contract once it has been deployed. The most basic way to interact with the contract is through the console that provides the Truffle tool, which as explained by Antonopoulos and Wood (2018) "is an interactive JavaScript environment that provides access to the Truffle environment and, via web3, to the block chain" (p. 235). Within this console, one can instantiate the intelligent contract that resides in the block chain, and through this instance make calls to the functions defined in that contract.

To be able to execute the functions of an intelligent contract, you must have an instance of it. To obtain it, through the Truffle console a variable is assigned to the contract display by executing the command Titulos = Titulos.dployed() which will generate an output corresponding to all the information of the contract, such as the name, the code that composes it, the compiled code and the ABI or Binary Application Interface which, in Ethereum, is basically the way in which the contract calls can be made.
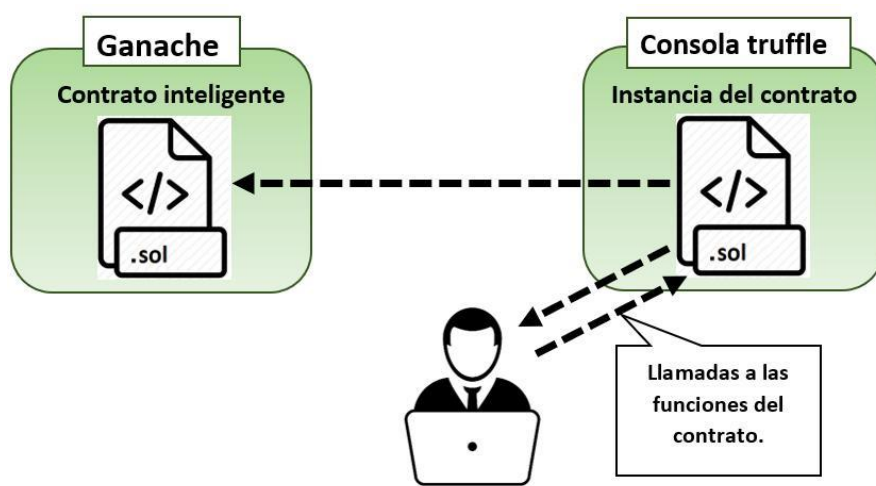
Figure 6. Diagram of the process of user interaction with the intelligent contract once it has been deployed

Once the contract instance is obtained in the te Truffle console, the commands executed through this instance will be reflected in the block chain as transactions and mined blocks as long as these transactions have been successfully executed.

6. Conclusions

Through this research it has been possible to establish an application model together with all the technological components that make up the architecture based on blockchain technology for the registration of academic titles. In addition, it has been possible to verify the feasibility that blockchain presents to be used as an architectural basis for the development and deployment of intelligent contracts. For this purpose, two intelligent contracts were designed, a main one to manage the creation of registries for both degrees and students, as well as to allow for the assignment of degrees; and a secondary one that

serves as a support by providing additional functionalities required by the main contract in order to carry out its tasks.

It was possible to verify that the methodology proposed in this article is valid for the development of intelligent contracts. This is due to the fact that the phases proposed in this methodology allow for a clear picture of the development from start to finish. In addition, in each phase an analysis is made or a set of specific steps is followed that allow to speed up the processes and reduce errors.

To speak of Blockchain is, without a doubt, to speak of a significant technological revolution since it offers an extraordinary potential especially in those areas where a reliable and immutable registry of each transaction is required as for example the registry of academic titles, that's why its utility transcends the cryptomonalities and with the appropriate instruments as for example Ethereum, all that potential can be exploited.

Making the registration of academic titles through intelligent contracts on Blockchain technology would generate an enormous impact for higher education since it would allow to maintain a highly reliable record of the titles that a person has without being able to modify it and at the same time it is available to the general public so that they can access this record either for information purposes or for data validation ensuring that if a title has been assigned to a student within this record in the blockchain it is legitimate.

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Authors

LUIS ROSERO-CORREA. He is a computer engineer graduated from the Central University of Ecuador.

MARIO MORALES-MORALES. He is a systems engineer graduated from the Escuela Politécnica Nacional, Ecuador. He studied a master's degree in business administration at the Universidad San Martín de Porres, Peru. He has obtained certifications in project management (PMI) and data analysis, with extensive experience in business projects in the Andean region.

He currently teaches at the Faculty of Engineering, Physical and Mathematical Sciences of the Central University of Ecuador, and is studying for a PhD in Computer Science at the University of Alicante.

SANTIAGO MORALES-CARDOSO. Doctor in Computer Science from the University of Alicante, Spain. He obtained a degree in computer engineering, a master's degree in engineering sciences and a master's degree in computer business management at the Central University of Ecuador.

He currently teaches at the Faculty of Engineering, Physical Sciences and Mathematics.

Análisis de la implementación del portal de servicios educativos: EducarEcuador

Analysis of the implementation of the educational services platform: EducarEcuador

Santiago Vinueza-Vinueza

Universidad Central del Ecuador, Quito, Ecuador

sfvinueza@uce.edu.ec

http://orcid.org/0000-0002-0818-6554

Joshua Pozo-Caicedo

Universidad Central del Ecuador, Quito, Ecuador

jdpozo@ uce.edu.ec

https://orcid.org/0000-0001-9482-5369

Anthony Pacheco-Gallegos

Universidad Central del Ecuador, Quito, Ecuador

aspachecog@ uce.edu.ec

https://orcid.org/0000-0002-8908-0363

Richard Arequipa-Caisaluisa

Universidad Central del Ecuador, Quito, Ecuador

rsarequipa@ uce.edu.ec

https://orcid.org/0000-0001-5756-450X

Resumen

Este artículo presenta el análisis sobre la implementación de la plataforma educativa EducarEcuador en el sistema de educación nacional, además, la importancia del uso de las plataformas virtuales en la actualidad. Es necesario recalcar que existen zonas que por su ubicación geográfica y económica no disponen de acceso a tecnologías de la información y comunicación (TIC). La investigación nos permitirá conocer el estado de la implementación de la plataforma virtual EducarEcuador. Esta investigación se realizará a partir de una revisión de diferentes fuetes bibliográficas, se indagaron experiencias y resultados de investigaciones sobre la plataforma EducarEcuador. También se usaron los resultados obtenidos del análisis de documentos estadísticos del Ministerio de Educación y del Instituto Nacional de Estadísticas y Censos (INEC). Sin embargo, las investigaciones encontradas son a nivel institucional, cantonal o provincial. Lo cual no permite conocer el estado real de la implementación de la plataforma EducarEcuador en todo el ámbito educativo ecuatoriano. La investigación busca evaluar el índice de la incorporación de la plataforma virtual en las instituciones educativas del país. A Entre los resultados se percibe que la implementación y el manejo de las herramientas de la plataforma ha tenido una mayor acogida en la jurisdicción fiscal. Además, se percibe la falta de infraestructura tecnológicas en el país. En consecuencia, la ausencia de infraestructura limita al manejo de la plataforma educativa. No obstante, no limita solamente a los usuarios sino limita fuertemente la implementación de esta plataforma.

Palabras clave

EducarEcuador, gestión escolar, MinEduc, servicios escolares.

Abstract

This article presents the analysis of the implementation of the EducarEcuador educational platform in the national education system, as well as the importance of using virtual platforms today. It is necessary to emphasize that there are areas that due to their geographical and economic location do not have access to information and communication technologies (ICT). The research will allow to know the status of the implementation of the virtual platform EducarEcuador. This research will be carried out from a review of different bibliographic sources, and experiences and research results on the EducarEcuador platform were investigated. The results obtained from the analysis of statistical documents of the Ministry of Education and the National Institute of Statistics and Censuses (INEC) were also used. However, the investigations found are at the institutional, cantonal or provincial level. This does not allow knowing the real status of the implementation of the EducarEcuador platform in the entire Ecuadorian educational environment. The research seeks to evaluate the rate of incorporation of the virtual platform in the country's educational institutions. Among the results, it is perceived that the implementation and management of the platform's tools has been more well received in the jurisdiction. In addition, the lack of technological infrastructure in the country is perceived. Consequently, the absence of infrastructure limits the management of the educational platform. However, it does not only limit users but it strongly limits the implementation of this platform.

Keywords

EducarEcuador, educative management, MinEduc, school services

1. Introduction

This article aims to analyze the level of implementation of the EducarEcuador educational platform. This platform was developed and implemented by the Ministry of Education to improve the quality of educational service in the country. In this regard Cabero (2005) says "These programs allow to carry out a series of activities such as: locating different types of documents texts, images, web addresses, computerized collective presentations...)" (p. 8). Therefore, educational platforms seek to help and facilitate processes for the educational community. However, after its implementation, shortcomings were disclosed within the operation and accessibility to the educational platform EducarEcuador.

For the preparation of this article, the search for information has been one of the main obstacles, since the EducarEcuador page filed errors on the servers, which made it difficult to extract the information necessary for the article. In addition, the scarcity of bibliographic sources was a limitation since, there are not many studies about the analysis of the virtual platform in the different types of educational institutions. The challenge is intended to determine the level of implementation of the educational platform at the national level, in addition to determining the difficulties presented by the educational community, students, teachers, parents, when accessing the virtual platform EducarEcuador, in the different regions of Ecuador.

If wanting to improve the teaching-learning process through the use of educational platforms, it is essential to know it in depth. According to Taipe (2016):

> The virtual education platform has been one of the fundamental pillars in the construction of knowledge, in training through the Internet, collaborative learning can be facilitated by synchronous or asynchronous tools such as chat, email or distribution lists and forums (p. 24).

It is very important to know about these tools, since it will help improving the learning teaching process; it is important also important to know the advantages and disadvantages that the use of the platform has. In addition to the factors that influence the external and internal use of the EducarEcuador platform.

With the analysis of the educational services platform EducarEcuador, it is intended to determine the main access shortcomings for users such as: students, parents, teachers and the educational community in general. In addition to its implementation at the national level in order to get a diagnosis to provide an objective opinion of what the possible solutions may be for the platform to be as successful as other educational platforms. Ecuador needs a stable and user-friendly platform in order to modernize the current education system, thus this analysis is necessary.

The objective of this article is to carry out an analysis of the educational services platform EducarEcuador, in order to identify the functions and services provided by that platform to the educational community, in addition to identify the difficulties that arise when accessing the virtual platform EducarEcuador in rural areas of the country. It is necessary to determine the behavior of the platform both on the coast, mountains, east and island region of the country, hence the idea is to answer the following questions:

- What is the implementation level of educational institutions by school period to the EducarEcuador platform?
- What are the difficulties for the educational community in rural areas when accessing the virtual platform EducarEcuador?

This research is focused at the national level, since EducarEcuador platform is developed and implemented in the education system by Ecuador's Ministry of Education. This covers the education system for both the coast and the mountains. The difficulties that arise to use the EducateEque platform in certain educational sectors such as rural areas could be an obstacle to the development of a modern education. Thus, the purpose of the article is to show the shortcomings presented by the educational platform of the Ministry of Education (EducarEcuador), conducting a technical and comparative analysis with other educational platforms.

The article is structured in six sections. The first section refers to the introduction of the article. The second section introduces the concepts related to the virtual platform EducarEcuador. The third section discusses a variety of bibliographic sources that present results and conclusions related to the EducarEcuador virtual platform. The fourth section presents the methodology used to develop this article. The fifth section discloses the results obtained about the analysis of the virtual platform EducarEcuador. Finally, the sixth section determines the conclusions based on the results of the analysis of the EducarEcuador educational platform.

2. Related concepts

2.1. ICTs in Education

The implementation of information and communication technologies (ICTs) within a knowledge society has caused changes. Education is one of the main users of ICT and has made a major improvement in the teaching -learning process. According to Hernandez (2017) "one of the areas with more influence of technology is in school, and this in turn in the teacher, being technology an essential part of school daily life" (p. 5). Hence, it can be understood that the inclusion of ICTs into the educational field is meaningful to a significant progress for both the student and the teacher. ICT tools play a facilitator role between the student's relationship with knowledge acquisition, as well as facilitating the teacher's work with their tools.

The degree of importance in ICT management is not yet known. There is no doubt that technology plays a very important role in the education system. The technology facilitates the teaching process either virtually with the management of platforms or using devices such as projector, computer, calculator, internet, etc. However, Vinueza-Vinueza y Simbaña-Gallardo (2017) states that "Ecuador has delays in the use of ICTs and communications infrastructure, a situation affecting national productive development and job creation for young people entering the labor market" (p. 7). Over the years, access to computer tools, such as computers or the Internet has increased, however, there are areas of the country where they people do not have access to them as in the case of the internet. This is due to the lack of infrastructure and the technological levels in the country.

2.2. Educative virtual platforms

The use of virtual platforms in the education system has innovated not only the organization of data, but has also presented as a pedagogical aid for both teachers, students and parents. In addition, such platforms such as: Caroline, Moodle, etc, facilitate the display of information that teachers consider important. Taipe (2016) states that "virtual learning environments have the great advantage of being a tool to bring new innovation options for these processes" (p. 3), suggesting that virtual platforms are useful in educational processes, in addition to the use of ICTs in education, computer tools are presented in an innovative way thanks to globalization and the development of technology.

Educational virtual platforms work efficiently, so these platforms present numerous applications for all kinds of activity whether informative, submission of assignments or evaluations, as to facilitate the educational management of both teachers and students and those involved in the educational system. In this regard, Sánchez (2016) says "the term platform encompasses a wide range of computer applications installed on a server, whose function is to make it easier for teachers to create, administer, manage and distribute courses on Internet" (p. 218). Hence, through virtual platforms students can work in real time and communicate.

Just as there are numerous advantages of educational virtual platforms, there are also certain disadvantages, since not all students have access to the internet; therefore, it would represent financial expenses in computer centers or transportation to go to a library. In addition, students need to be committed to the activities they develop, since it depends on their willingness to obtain an effective work.

There are 3 types of virtual platforms which are used for different types of jobs. Each of these three types have different characteristics and their functions are specific to each of them, which are shown below:

- **Commercial platforms.** These are platforms that require a prepayment before using and thus be able to access the information. This type of platform does not allow its users to modify the system. Sánchez (2009) says "they are tools for which we have to pay an installation and/or maintenance fee". (p. 8). Other than being very useful in the educational process, maintenance is fast and efficient, as is the technical service that this software offers, allowing the software to be comfortable and to be of pleasure for users.
- **Free Software Platforms.** Such platforms are free of charge, i.e. no payment is required to access the information. In addition to making modifications to the system, Sánchez (2009) says "in most cases there is no payment for updates or number of licenses" (p. 222). Therefore, it is confirmed that such platforms provide a free service.
- **Own Software Platforms.** Own software platforms are developed for the internal use of an educational institution; their purpose is to meet a specific need for the institutional community; therefore, such platforms are not for public or commercial use. In this regard, Sánchez (2009) says "they are not usually publicized or sometimes offered to the Internet community for responding to specific educational situations". (p. 220). Therefore, this type of software is developed for the school's own use.

2.3. Virtual platforms and their importance

Due to the current health crisis experienced due to COVID-19, there are different global drawbacks in different areas, such as: economic, political, educational, etc. Therefore, today there are different platforms created by private and public institutions, which contribute to social, work and educational development. According to Cevallos et al. (2019) "an important number of public and private sector organizations are promoting the design and implementation of virtual computing tools and virtual learning objects" (p. 69). Therefore, virtual platforms are the main tools used today for different purposes, whether work, social or educational as an alternative to the impossibility of attending jobs, schools and universities.

However, virtual platforms have both disadvantages and advantages. There are users who use such platforms to share erroneous information, causing other users to get confused. In this regard, Cevallos y Villanueva (2019) states that "the advantages in digital handling can be taken into account, however, it should not be overlooked that, thanks to digital advancement, some users disclose irrelevant information" (p. 3). Therefore, the idea is that virtual platform is used in

order to share information that is useful for the society and for the performance of different functions.

There are different advantages offered by virtual platforms. The correct use of the virtual tools currently helps the continuity of work and studies, in addition to keeping the communication among the different users, as stated by Jaime (2019):

> Web pages are means of communication that allow the user to communicate with a content and also comment and interact with other people. If the person does not have encyclopedias nearby and need to search for instant information without getting into the content, the person can search for information on web pages, and this is a great advantage since the information is obtained quickly. People can enter at any time and from any computer (p. 10).

Thus, it can be said that the correct use of virtual platforms is very useful, whether in the social, economic, social and educational spheres, because it contributes to the progress of society.

Similarly, misuse of virtual platforms causes confusion and delays in work and studies, because erroneous or unimportant information can be transmitted, so the commitment of users is also to be responsible when using them, equally a significant disadvantage lies in the interest that users give to such platforms. In this regard, Jaime (2019) expresses:

> Anyone in the world can upload information that is not true simply because it benefits it in some economic or social sense. Isolation between human beings, eliminating physical social interaction requires technical equipment and resources. The files are stored on the server of the institution or company that offer computer tools, becoming vulnerable to users. It can become a problem; it can be evidenced if it is not guided correctly and if strict control is not maintained in its use (p. 11).

According to the statement, it can be said that misuse of technological tools can cause different problems to the community.

2.4. EducarEcuador Plataform

It is an educational platform that invites the community to be part of the automation of services in a process of continuous improvement with the aim of providing quality services to the citizens and getting closer to it, through the use of technological tools available to the entire educational community.

It is the educational platform that facilitates the monitoring and control of educational management to contribute to the continuous improvement of the quality of education through the implementation of virtual services such as: school control management, teacher management, citizen formalities, etc. According to the Ministry of Education (2009):

> EducarEcuador offers its online educational services to the different actors of the educational community: students, teachers, authorities of educational institutions, parents and community that are part of the public education system, as well as the service for the collection of pensions, tuition and educational services for private and public educational institutions (p. 1).

As stated above, the virtual educational services platform EducarEcuador, generates facilities of access to citizens and satisfies the demand of a modern institution that is at the forefront of the use of information technologies.

3. Related works

In 2018, a study was conducted which studied the management of the EducarEcuador platform to 132 teachers belonging to the school "Santo Domingo de los Colorados", and it was observed that 74% of teachers knew about how to use the virtual platform, while 26% did not have any knowledge about how to use the platform. Therefore, the authors conclude that training workshops should be held for those teachers who do not efficiently manage the virtual platform, and then evaluate them again (Mora-Zambrano, Bonilla-Jurado, Núñez-Freirere y Sarmiento-Saavedra, 2018).

A study was conducted in 2018 at Dr. Leónidas García Ortiz, Riobamba on the EducarEcuador platform to evaluate the difficulties of teachers in that school. The results determine that there are problems in the management of the EducarEcuador platform. Therefore, the author concludes that the problem lies in the lack of knowledge of technological tools, which makes the teacher feel unsafe to execute organizational and storage activities of information, content and data on digital platforms (Aliaga-Erazo, 2018).

In a study carried out in 2017, the use of the virtual platform EducarEcuador was diagnosed to 121 teachers from different public schools in the city of Calceta. The results show that approximately 66.4% of teachers manage the platform efficiently, while 33.6% would not handle the platform correctly. Therefore, the author concludes that the number of hours provided to teachers for the efficient use of the platform are not enough (Lopez-Alava, 2017).

In 2016, a research studied the use of the EducarEcuador platform of teachers' educational activities at the school "Mitad del mundo". The results yield a set of deficiencies such as: there is no control over the schedule set on the platform, teachers do not have the adequate knowledge to send or locate the tasks uploaded by their students, inconveniences aroused in the academic performance, they do not have sufficient knowledge for the management of the office packages of the platform (Barrionuevo-Murminacho, 2016).

In a study in 2016, a research was carried out to the educational institutions corresponding to the cantons of Balsas, Marcabelí and Piñas in the province of El Oro, which make up the 07D04 district of Education. The results determine that a small number of teachers use the Educational Platform EducarEcuador, especially because of the lack of knowledge and training received for the use of teaching tools. It highlighted the need for a training plan aimed at acquiring the knowledge and skills in the use of the teaching tools of the Educational Platform EducarEcuador so that they can be applied in their teaching work (Urgilés-Paredes, 2016).

The research of Pachakutik (2016) aimed to evaluate the level of incidence of the use of the educational platform EducarEcuador in the monitoring and academic control of students of the school "Milenio Intercultural Bilingüe "Chibuleo". The aim was to measure the incidence level of the use of the educational platform EducarEcuator of parents in the academic monitoring and control. Based on the results obtained after the survey of the parents, it is determined that the parents in an average percentage equivalent to 39% and low equivalent to 35% do not use the educational platform EducarEcuador. Thus, the researcher proposes a guideline for the use of the platform EducarEcuator for parents to improve academic monitoring and control (Guapizaca-Jinde, 2016).

In 2016, research investigated the virtual platforms in the teaching-learning process of students coursing the 1st level of High School at the school "Atahualpa", Tungurahua province. The results of this research indicated that very few teachers know or are familiar with the usefulness of a virtual platform; students say that the teaching-learning relationship would improve if a virtual platform were used, which would act as a cross-cutting axis that would help improve their understanding; teachers say that using a computer tool such as the virtual platform would improve the student teaching relationship (León-Taipe, 2016).

In another research conducted in 2015 on the use of the EducarEcuador platform to teachers at the public-school Ochoa León, pasaje city, the results indicated that teachers are in a process of using the platform, since it is presented as an innovative strategy in the educational processes. The author concludes that the EducarEcuador platform serves as an aid for both teachers, students and parents in the different educational processes, thus achieving a change in education (Mejia-Herrera, 2015).

In 2012, a research carried out the evaluation of the educational platform EducarEcuador of teachers of the school "Consejo Provincial de Pichincha", and its impact on the approach of a reengineering proposal. From the results, it is obtained that 25.46% of teachers are satisfied with the availability of the resources and content. 56.52% of teachers are unsatisfied when using the resources or the platform. This observation must be given special attention in the reengineering of the platform (Ochoa-Saeteros, 2012).

4. Methodology

The following describes the steps used in this research:

1. **Selection of literature related to the research topic:** repositories were used with information about the EducarEcuador platform, in addition to the statistics presented on the platform.
2. **Evaluation of results from researches:** statistics and bibliographic documents were evaluated to determine the access of the platform. It will establish which institutions use the platform the most.
3. **Feasibility level of EducarEcuator platform**: the results were analyzed in order to establish the quality of operation and the skill of platform management by the educational community.

5. Results

Ecuador's Ministry of Education (2019) collects data from public, private, and municipal institutions (students, teachers, institutions) at the national and territorial level at the beginning and end of the school year. Information is available from 2009-2010 to 2018-2019. With the information obtained in the period 2018-2019, it is determined that the platform is used in 16200 educational institutions. There are currently two educational periods, the Costa school period, which covers the Galapagos, and the Sierra school period which covers the Amazon region. The Costa region is made up of 9484 institutions as can be seen in Table 1. The Highland period consists of 6716 educational institutions, as can be seen in Table 2.

Area	Public	Semi-private	Municipal	Private	Total
Rural	3682	52	13	98	3845
Urbana	3908	131	30	1570	5639

Total	7590	183	43	1668	9484

Table 1. Coast school period. Fuente: (Ministerio de Educación, 2019, pág. 2)

Área	Fiscal	Semi-private	Municipal	Particular	Total
Rural	3145	153	11	320	3629
Urbana	1674	216	61	1136	3087
Total	4819	369	72	1456	6716g

Tabla 2. Highland school period. Fuente: (Ministerio de Educación, 2019, pág. 2)

5.1. Use index of EducarEcuador platform

EducarEcuador is an educative platform, for this reason various educational institutions do not use all its tools; however, it should be emphasized that all educational institutions use EducarEcuador platform to carry out the qualification process. Because of this, public institutions have had an increase in annual registration on the platform, see Figure 1.
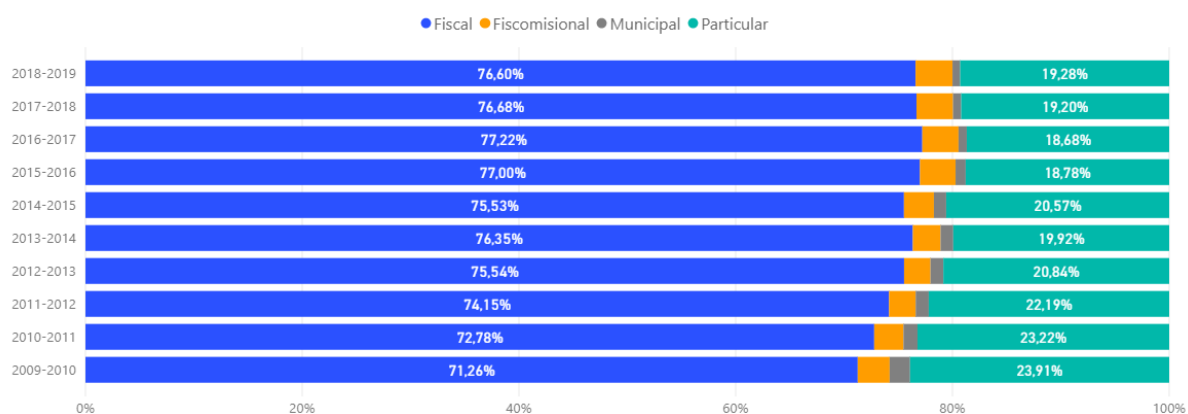

Figure 1. By period and sustenance. Source: (Ministerio de Educación, 2019, pág. 1)

In public schools, the utilization rate has increased from 2009 to 2019, since in public schools it has increased 5.35% and in fiscomisional schools by 0.47% in the acceptance of the EducarEcuador platform. While in municipal schools the acceptance rate has declined by 1.17%; in private schools it has declined by 4.63%. Thus, it is assumed that the EducarEcuador platform is not 100% accepted in the national level.

5.2. Assessment of accessibility

In order to evaluate the accessibility of the EducarEcuador platform, a bibliographic analysis is used, in addition to experiences that were shared by various people who are related to the educational system. According to the latest census conducted by INEC (2016), it is established that "36% of households nationwide have access to the internet, 13.5 points more than five years ago. In the urban area growth is 13.2 points, while in rural is 11.6 points" (p. 7). Ecuador is in a major back in the technology, information and communication infrastructure, and one of the most important indicators is internet access, in which until 2016 the country has only 36% coverage nationally, see Figure 2.
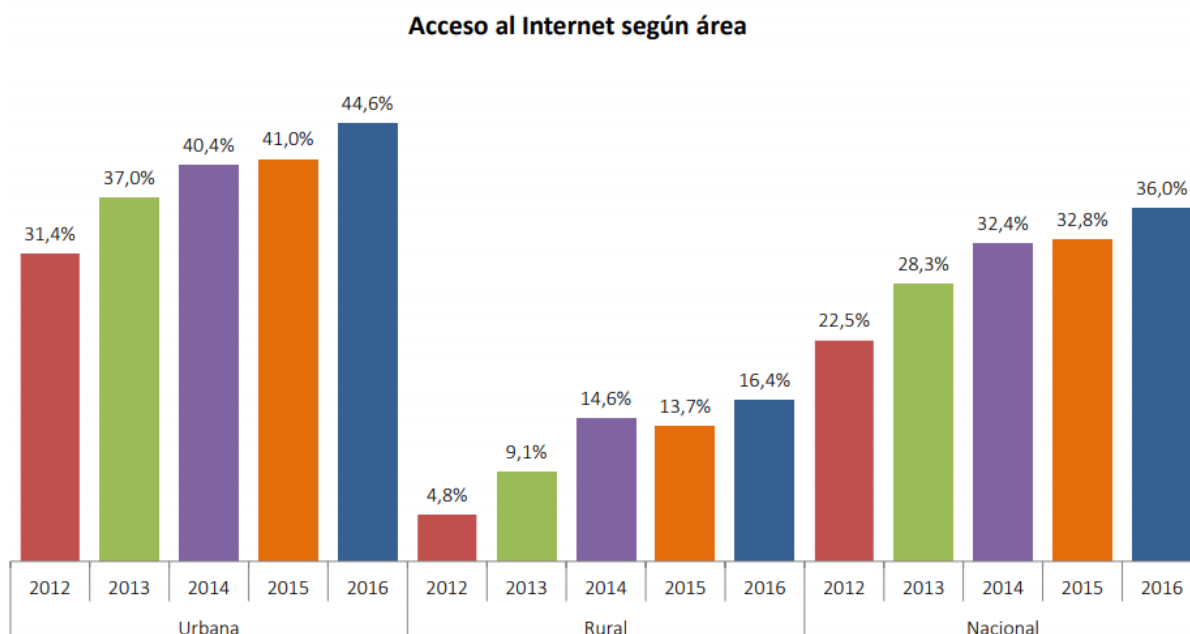
Figure 2. Internet access according to the area. Source: (INEC, 2016, pág. 4)

From this figure it can be corroborated the experiences that states that it is very difficult for students to manage the platform 100%, because not all students have internet in their homes or own a computer.

There are several drawbacks that hinder the accessibility and management of the platform, among these are internet access, home equipment, and even the skill of the users of this platform. Not everyone has the ability to manage technology, these include teachers, as there are many teachers who are even elderly and have difficulty managing technology. There are also cases where teachers have to mobilize from the community they are in, in order to have access to internet and upload their students' grades to the platform. However, the drawbacks are only on the part of users, and the ICT infrastructure also has an impact on technical problems of the platform.

The main problems observed are the collapse of the platform for several days and the non-compliance with the platform's enablement dates so that teachers can upload the student´s grades; this is evidenced up to one week before the completion of the first term.

6. Conclusions

With the results presented in this research on the implementation of the educational platform EducarEcuador, it is shown that this platform has had a high utilization rate by the educational institutions of Ecuador. Thus, the educational platform is implemented in all schools at the national level. In contrast to the results, semi-private schools, municipalities and individuals also use the educational platform EducarEcuador, thus increasing the level of acceptance of the platform at the national level. This is demonstrated in the fact that private schools registered on the EducateEcu platform only to carry out the process of graduating their students, since it is a requirement validated by the Ministry of Education.

There are certain limitations in rural areas to access the platform, either because of the lack of internet service, which causes users to move to another place to access the platform. In addition, the lack of technology management and access to it in rural areas cause teachers and the community not to become familiar with computer tools, which are the main problems for educators not to handle the EducarEcuador platform in an optimal way, the problem of platform management increases in older teachers, since they find it difficult to manage not only the EducarEcuador platform, but the computer tools.

This research proves, the necessity of technology in the field of education in Ecuador. In addition, it is observed that the educational platform EducarEcuador is a useful tool in the educational system. However, this tool is not fully exploited by teachers and students by factors such as limitations on internet access and ignorance of teachers in the use of the EducarEcuador platform. From the factors set out above, it can be said that the Ecuadorian education system does not show any advance in the technological field.

The importance of the use of virtual platforms today is reflected in the need of the different public and private institutions, in the production of work through virtual meetings and online works, as well as in the educational field, since various educational institutions have been forced to use educational tools, such as virtual educational platforms, with the purpose of reinforcing and maintaining academic continuity.

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Authors

SANTIAGO VINUEZA-VINUEZA obtained his master's degree in Communications Networks, from the Faculty of Engineering, Pontificia Universidad Católica del Ecuador in 2016, Master in Educational Computer Systems, Universidad Tecnológica Israel in 2009, Bachelor of Education Sciences, specialization in Computer Science, Faculty of Philosophy of Letters and Educational Sciences, Universidad Central del Ecuador in 2002, Engineer in Computer Execution , Universidad Autónoma de Quito in 2002.

He is currently an Associate Professor at the Faculty of Economic Sciences at Universidad Central del Ecuador. Main member of the severance fund of Universidad Central del Ecuador, Member of the H.C. directive of the Faculty of Economic Sciences of Universidad Central del Ecuador,

Coordinator of the Degree Unit of the Finance Career of Universidad Central del Ecuador, Coordinator of the Information Systems subject of the Faculty of Economic Sciences of Universidad Central del Ecuador. His main research is part of the educational field and Information and Communication Technologies.

JOSHUA POZO-CAICEDO Currently, he is coursing the third semester student of computer sciences, Faculty of Philosophy, Letters and Education Sciences of Universidad Central del Ecuador. Third-level student of the Adequacy of English at the Language Center of Universidad Central del Ecuador.

ANTHONY PACHECO-GALLEGOS Currently, he is coursing the third semester in pedagogy of computer experimental sciences at the Faculty of Philosophy, Letters and Educational Sciences, Universidad Central del Ecuador. He is in the second level of English Adequacy at the Language Center of Universidad Central del Ecuador.

RICHARD AREQUIPA-CAISALUISA Currently, he is coursing the third semester in pedagogy of computer experimental sciences at the Faculty of Philosophy, Letters and Educational Sciences, Universidad Central del Ecuador.

Innovación didáctica para la comprensión del concepto de vacío en hidrostática

Didactic innovation for the understanding of the concept of vacuum in hydrostatics

Franklin Molina-Jiménez

Universidad Central del Ecuador, Quito, Ecuador

femolina@uce.edu.ec

https://orcid.org/0000-0002-2374-2192

Lucia Goyes-Chulde

Unidad Educativa Municipal Calderón, Quito, Ecuador

uemc.lgoyes@gmail.com

https://orcid.org/0000-0001-7806-5312

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Resumen

El presente artículo describe una propuesta de innovación didáctica dirigida a mejorar la comprensión del concepto de vacío, que es estudiado en la hidrostática rama de la física y constituye uno de los temas más complejos e importantes de comprender, ya que está involucrado en muchas actividades que el ser humano desarrolla, desde el proceso fundamental de respirar, hasta el de generar numerosos avances científicos e industriales.

La ausencia total de la materia en un determinado lugar recibe el nombre de vacío, ha sido analizada de varias formas, principalmente de forma experimental, sin embargo, la presente propuesta está dirigida a estudiarla desde el punto de vista teórica y comprobar su existencia en forma práctica, a través de la aplicación de la técnica didáctica de la pregunta respuesta y de la estrategia grupal investigación en el laboratorio respectivamente.

La investigación se desarrolló bajo un proceso de índole cuantitativo, cuasi experimental, inductivo en la que intervinieron treinta y tres estudiantes de la Carrera de Pedagogía de las Ciencias Experimentales, Matemática y Física, quienes trabajaron en dos momentos, en los que se estableció que el porcentaje promedio de comprensión del tema analizados en el

*pr*etest y *postest* se incrementó del 44.70% al 79.55%. Esto permitió intuir que el empleo de la propuesta de innovación didáctica, basada en la aplicación de la técnica didáctica preguntas respuestas y de la estrategia investigación de laboratorio conllevó a mejorar la comprensión del concepto de vacío, además de verificar cómo influye este en el quehacer diario.

Palabras clave

Comprensión, didáctica, estrategia, innovación, técnica, vacío.

Abstract

This article describes a proposal of didactic innovation aimed at improving the understanding of the concept of vacuum that is studied in the hydrostatic branch of physics, and constitutes one of the most complex and important topics to understand, since it is involved in many activities that the human being develops, from the fundamental process of breathing, to the one of generating numerous scientific and industrial advances.

The total absence of matter in a given place is called a vacuum, and it has been analyzed in several ways, mainly in an experimental way. However, the present proposal is aimed at studying it from a theoretical point of view and verifying its existence in a practical way, through the application of the didactic technique of the question-answer and the group research strategy in the laboratory, respectively.

The research was developed under a quantitative, quasi-experimental, inductive process in which thirty-three students of the Pedagogy of Experimental Sciences, Mathematics and Physics Career took part. They worked in two moments, in which it was established that the average percentage of understanding of the subject analyzed in the pre-test and post-test increased from 44. 70% to 79. 55%, allowing us to intuit that the use of the didactic innovation proposal, based on the application of the didactic technique questions and answers and the laboratory research strategy, led to a better understanding of the concept of vacuum, in addition to verifying how it influences our daily work.

Keywords

Understanding, didactics, strategy, innovation, technique, emptiness.

1. Introduction

Physics, being an experimental science that studies all the phenomena that govern nature, means that the learning and understanding of this branch of human knowledge is not forged from an agile menara in the cognitive structure of the students that attend the different academic levels where this science is taught. In addition, the nature of science and the development of scientific knowledge significantly influences the way it is taught, being reflected in the methods used by the teacher, in their performance and decision-making in the natural science classroom, as pointed out by Rua and Alzate (2012), these notions create the need to seek teaching strategies that allow for a better understanding and analysis of these phenomena that are studied in the classrooms of the Experimental Mathematics and Physics Science Teaching Career and then tested and verified in the laboratory of the Physics Unit of the Central University of Ecuador, by students in regular courses.

The present research work presents an innovative didactic proposal that seeks to improve the understanding of the concept of vacuum, which is analyzed in hydrostatics, a branch of

hydraulics that studies fluids in a state of equilibrium. This proposal is oriented to enable students to effectively assimilate the concepts related to it.

The didactic proposal is based on the process of asking the students questions, since the art of asking is the art of continuing to ask, and this means that it is the art of thinking (Gadamer, 2007), which will allow us to determine the level of knowledge acquired by them when observing the recreation of the vacuum phenomenon in the physics laboratory.

The aim is to create an innovative teaching alternative, in an attempt to generate understanding not only of the proposed subject, but of others related to physics, so that other teachers working in the centre of studies where the research is being carried out can improve their teaching and learning process and thus the academic performance of the students, which for Cascón (2000) "constitutes the demonstration of their knowledge of the different areas or subjects, which the system considers necessary and sufficient for their development as active members of society" (p.11).

Related works such as Urbina's 2008 and Sanchez's 2010, the use of questions in the university environment is considered as background to the research carried out. In this document a review of the research carried out is made, the definition of didactic innovation is analyzed, the level of understanding according to Bloom's (2013) " the study of the concept of vacuum and others related to the east through the use of physics laboratory equipment that allows to determine the difference of pressures between two media (p. 2), the absence of sound in the vacuum, the methodological process carried out to execute the research with its respective statistical analysis of the results obtained when applying a pre-test and post-test, to finally present the conclusions.

2. Theoretical Foundations

2.1 Teaching innovation

One of the characteristics that every teacher must possess is the willingness to always modify his or her way of teaching, since teaching physics is a function of scientific and technological advances. That is to say, to generate activities that involve processes of educational innovation, an aspect that Imbemón 1996, González and Escudero 1987 point out as an action or sets of actions that lead to internal and qualitative changes in a teacher's educational work in order to improve understanding, efficiency and effectiveness in the solution of problems generated immediately.

According to Tejada (2012), innovation can be considered to be t"he nucleus of a renovating action generated within the classroom (p. 6). Renewals imply new situations within a context that can sometimes generate reforms in educational processes. However, these innovations cannot always generate reforms, establishing that the teacher must innovate to renew the teaching strategies used in the teaching process with their students, an action that develops in the classroom in order to understand the concepts in a meaningful way.

These significant learnings should be considered to be the product of innovative experiences that for Torre (1997) "can become the first phase of more far-reaching innovations" (p.46). Confirming that innovations arise from innovative experiences generated in the classroom.

In this perspective Capelástegui affirms that one of these innovative experiences linked to the initiative generated by the teacher in his didactic procedure, is that of seeking changes in the use of didactic strategies oriented towards the transfer of knowledge, group work, collaborative work and the simulation of real situations, aspects that are considered in the present investigation (Capelástegui, 2003).

The principles of constructivist learning founded by Piaget 1929, Vygotsky 1930 and Ausubel 1978 establish that the subject constructs knowledge in an active way, interacting with the object of study. In the case of learning physics, this is done in the laboratory. The new knowledge acquires meaning when it is related to the previous knowledge, that is to say, the concept of vacuum will be well founded when the student understands the meanings about hydrostatics, atmospheric pressure and boiling; and is able to find the applications that the concept of vacuum has in everyday life.

According to Oviedo (1983), the use of didactic procedures to obtain a certain result "includes strategies and techniques" (p. 24). According to Szczurek (1989), strategy is the "set of deliberate actions and organizational arrangements to coordinate (direct) the teaching and learning system" (p. 89). These strategies may be masterful, cooperative, individual, and group strategies.

In this research, the group strategy is applied since it emphasizes the joint work of students in cooperative learning activities, subordinated to the tutoring of the teacher in which his or her role constitutes being a learning facilitator, as stated by Bastidas 2004. The group strategy with which they develop the entire research process includes experimental work in the laboratory. Its importance lies not only in the possibility of observation and experimentation on reality and development of experimental skills, but also and perhaps more strongly in the possibility they offer to relate theories and models with experience and to provide an opportunity for students to know how scientific knowledge is constructed, as confirmed by Hodson (1988), who conceives "experimental work (laboratory practices) as a fundamental pillar for teaching" (p. 67).

According to Bastidas (2004), the technique constitutes a "particular way of using an instrument and/or resource on which teaching is based" (p. 121). The technique that is proposed to be used in research to improve the physics learning process is the question-answer, which allows the organization of mental schemes in students to facilitate the construction of concepts.

Gadamer (2007) points out that the "art of asking, is the art of continuing to ask and this means that it is the art of thinking" (p. 134). This allows us to affirm that the questions asked by scientists have allowed us to obtain decisive answers for the benefit of scientific development and to search for new strategies to improve science education.

Raising questions, whether by the teacher or the student, leads to developing in greater relevance the capacity to construct new significant knowledge that allows for structuring new mental schemes such as abstraction and reasoning, allowing for an increase in the scientific background of all those involved. Rojas (2009), in his research on the pedagogical function of the question in the processes of learning, reasoning, cognitive and metacognitive influences in science, determined that "questions systematically contribute to the construction in students of the processes of reasoning in Science" (p. 156).

Questions must meet certain basic characteristics in order to be asked. Rojas (2009), points out that questions must be reflexive, contextualised, decisive, divergent, linguistic and must include as requirements for their formulation the use of question marks at the beginning and end of the question, as well as having a subject, predicate and verb (p. 45).

2.2. Compression

According to Boostrom (2005) "real significant learning is not generated from activities involving memorisation but, on the contrary, activities that allow the exercise of skills for information processing" (p. 45) the acquisition and development of concepts, decision-making, the selection of alternatives, analysis, synthesis, interpretation, problem solving

and the creation of new ideas. In this sense, it is understood that teachers need to have a model that makes it possible to discern how to foster meaningful learning in students and that makes possible the development of these skills.

Within the Cognitive Taxonomy of learning proposed by Bloom are the levels of knowledge, understanding, application, analysis, synthesis and evaluation. In this sense, it can be established that comprehension constitutes the ability to understand or apprehend; where the student knows what is being communicated and makes use of the materials or ideas presented to him, without having to relate them to other materials or perceive the totality of their implications. The material requires a process of transference and generalization, which demands a greater capacity for abstract thinking (Bloom, 1964).

It requires the learner to explain the relationships between data or principles governing classifications, dimensions or arrangements in a given subject, knowledge of the fundamental criteria governing the evaluation of facts or principles, and knowledge of methodology, principles and generalizations, such as translation, interpretation and extrapolation.

Finally, understanding can be considered as a flexible performance capability which allows to establish according to Perkins (2003) that "understanding is the ability to think and act flexibly from what one knows" (p. 70). In this context, the idea of understanding occurs when the student is able to act flexibly in tasks that involve multiple responses and performance of activities oriented to generating significant learning processes.

2.3 The vacuum in hydrostatics

The concepts have been created since the human being had the capacity to abstract, that is, to take from the environment where we inhabit significant and intrinsic elements of each object or phenomenon and to associate those elements according to similarities and differences in order to generate knowledge. As Sager (1993) points out, concepts are used "to structure knowledge and perception of the surrounding world and make use of language for its formation and communication" (p.34). This argument guides the process of understanding many observable physical phenomena.

For Ausubel (1978) "concepts constitute objects, events, situations or properties that possess common criteria attributes and are designated, in a given culture, by some accepted symbol" (p.89); in this way, concepts are related among themselves to generate a new cognitive structure.

According to Moreira the acquisition of concepts can occur in two ways, by formation, in which concepts are acquired through direct experiences during different stages of human development and by assimilation in which concepts are formed as more vocabulary is acquired and associations can be established in the cognitive structure with these words and thus form a new cognitive structure (Moreira, 2010).

Taking into account the above, understanding the concept of emptiness becomes a little complex since the human being can infer the concept of matter in a general way to everything that surrounds us; that is, the amount of substance that occupies a place in space and possesses mass, form, weight and volume, so it is observable and measurable and even more so if we consider that Light does not have mass, however its energy and its moment can be measured.

Pierre Gassendi 1592, the pioneer of science, considered the vacuum as an undetectable medium where atoms could move, expand and compress. On the other hand, Newton recognizes vacuum as a means of absolute immobility. Christian Huygens defines it as a

subtle and elastic material medium. Nicolas Malebranch spoke of the elemental unity of subtle, psychic matter. Similarly, Benjamin Franklin 1752 spoke of a vibratory substance that filled all space, but shared with a hypothetical imponderable fluid, electricity. Additionally, Lomonosov defined it as a material medium that fills the interatomic interstices. Dalton considered it indispensable for the life of the atom. Charles Caesar, without enunciating the vacuum, describes the fact that a gas can disappear at -273 °. Augustin Fresnel recognized the vacuum as the material support of light waves. In Maxwell's theories, empty space appears as a conductor of stresses and energies responsible for electromagnetic actions.

In Maxwell's theories, empty space appears as a conductor of stresses and energies responsible for electromagnetic actions. In the 19th century, Ángelo Secchi points to vacuum as the cause of light and electric phenomena that vibrate in the former and move in the latter. The modern conception of vacuum is based on the experiment carried out by Torricelli, who in 1644 experimented with a vertical tube of one meter in length closed at the top, in which 76 cm of mercury rises under normal conditions over a receiver that is also full of mercury, this effect indicates the pressure of the surrounding air, in addition to the area of the tube above the limit of mercury being empty, a condition that allows mercury to be suspended (Young, 2009). This experiment reached the equivalence of atmospheric pressure with the height reached by mercury in an empty tube, which was called a barometer.

Otto Von Guericke in Germany in 1654 built the first vacuum pump to be able to suck the air inside a container composed of two attached hemispheres, which were pulled by 16 horses in two groups of 8 in opposite directions. (Young, 2009). With this experiment he showed that when the sphere was emptied of air, that is, when it was in a vacuum, the force of the horses was unable to separate the hemispheres, thus affirming that the pressure of the surrounding air exceeds the force performed by the horses and when the container contains air a slight force manages to take off the hemispheres, currently known as the Magdeburg hemispheres (Young, 2009).

Einstein considered the vacuum as the existence of electric masses, physical reality within the vacuum. Finally, it is possible to consider the conception of Carl Sagan (1980) astronomer, astrophysicist and scientific divulger recognized by his studies made on the structure of the universe, who affirmed that "The atoms are, in their greater part, empty space. Matter consists mainly of nothing..." (p. 160).

By virtue of these statements, the need and importance of developing a proposal of didactic innovation aimed at establishing new work alternatives both in the classroom and in the physics laboratory is establishe.

3. Metodology.

The proposal of didactic innovation is oriented to be developed in two moments. These are described below.

The first moment of the research is developed within the classroom of the Pedagogy Career of Experimental Mathematical and Physical Sciences of the Faculty of Philosophy, Letters and Education Sciences of the Central University of Ecuador, where the teacher, based on different activities, guides the students to the understanding of the concepts of hydrostatics, vacuum, atmospheric pressure, boiling, sound, mechanical wave, Magdeburg hemispheres. The thirty-three teacher-oriented students learn about the existence of vacuum with its properties and its importance through the execution of the master strategy, discussion-type lecture (Bastidas, 2004), in which the topics are previously studied by the participants, after

which they are discussed in learning groups. Participants can ask questions to the instructor or vice versa.

A masterful explanation is given based on four activities, how a vacuum is created using a device called a "vacuum pump" and the effects it produces on an inflated balloon and the incidence of this phenomenon on humans. The difference between the concepts of boiling and boiling generated in water is analysed. It is also explained that, in a vacuum, sound does not propagate and finally it is established how the pressure exerted by the air is in all directions through an instrument called the Magdeburg hemisphere. Once the concepts and examples have been exposed to the students, the level of understanding of them is verified through the application of the pretest (Table 1).

The second moment of the research is executed in the laboratory of the Physics Center of the Central University of Ecuador, where the work with the students is executed through the group strategy called laboratory research (Bastidas, 2004), which consists of collecting data in an organized and systematic way that proves or refutes theories and hypotheses, or that expands the knowledge of phenomena in situations controlled by all the students inside or outside a laboratory, but following the experimental method.

The thirty-three students, through an experimental process and guided by the teacher, performed four experimental activities using the pump, vacuum bell and plate, beaker, balloon, water, cell and Magdeburg hemispheres, as follows:

- The first activity is intended to verify the effects that the vacuum produces on a half inflated balloon inside the chamber. When the pump is turned on, the air inside is sucked out and the students observe how the balloon increases in size, a phenomenon that allows the students to obtain the respective conclusions, aimed at determining the degree of abstraction that the student possesses when faced with the physical phenomenon called homeostasis.

- The second activity proposed determines the difference between boiling and boiling, for which water is placed in a beaker, which is introduced into the interior of the vacuum chamber and then the pump is turned on. After a few minutes the students verify the boiling process of the water without increasing the temperature.

- The third activity verifies how sound, being a mechanical wave, needs a medium to propagate, while in the vacuum it does not propagate. To do this, a lighted cell phone is placed inside the vacuum chamber with the music player turned on, the air is extracted from the chamber and the sound is reduced.

- The fourth activity allows verifying the existence of the atmospheric pressure and how this acts on all the beings that inhabit the earth's surface, for which the laboratory equipment called Magdeburg hemispheres is used, which consists of two hemispheres joined together against each other, and that by sucking the air from the interior of the hemispheres using the pump generates the vacuum, remaining united in such a way that it is pulled from the ends by the students and by effect of the existence of the external pressure these do not separate.

The pre-test and the post-test are based on multiple choice items, in which there are questions with several answer options, of which only one is undoubtedly correct. (López, et al., 2013). These items seek the comparison and evaluation of ideas, concepts related to emptiness.

The questions posed in each of the items of the pre-test and post-test, which allowed the answers to be given to the research, are oriented in:

For the first activity:

- The balloon inside the vacuum chamber starts to increase its volume since the external pressure of the balloon compared to the internal pressure of the balloon is: higher, equal, lower or none.
- Homeostasis is a characteristic that bodies possess when the internal pressure of the body compared to the external pressure is: equal, greater, less or null.
- The balloon inside the vacuum chamber, increases its volume because it creates: large volumes of air, vacuum, high air masses or higher air density.

For the second activity:

- The water bubbles that are produced in a vacuum are the effect of: an increase in temperature, a decrease in temperature, the absence of air or an increase in the volume of air.
- The separation of water molecules inside the vacuum chamber is due to the water being in the process of: freezing, compression, boiling or decompression.
- Boiling means that the water temperature: decreases, increases, balances or deteriorates.
- Boiling means that the water molecules: join together, separate, intertwine or hit.
- There is some difference between boiling water and boiling water: yes, no, none or possibly.

For the third activity:

- The sound of the music emitted by the cell phone: it increases in intensity, decreases in intensity, maintains the intensity or disappears.
- The cause of not hearing the music inside the vacuum chamber is: too much air inside, a mass of air was created, no air or little air.

For the fourth activity:

- When you start pulling the ends of the spheres, they separate: yes, no, easily or with difficulty.
- The pressure that the air exerts around the hemispheres is: at the top of these, at the bottom, in all directions or in no direction.
- When opening the air inlet tap in the hemispheres, it: continues to exert pressure, continues to exert force, enters and separates the hemispheres or compresses the walls of the hemispheres.

By analyzing the number of correct answers after applying the pre-test and post-test to the students, it can be determined that they have been able to understand the concepts related to the vacuum, which would allow the generation of significant learning processes.

4. Results

In order to evaluate the understanding of what was done in an experimental way, students answer the questions posed in their worksheet, constituting the post-test. (Table 1)

QUESTION	PRE-TEST		POST-TEST	
ACTIVITY 1	**EFFECT OF THE VACUUM IN A BALLOON**			
RIGHT	13	39.39%	22	66.67%
WRONG	20	60.61%	11	33.33%
ACTIVITY 2	**THE DIFFERENCE BETWEEN BOILING AND BOILING WATER**			
RIGHT	15	46.46%	28	84.85%
WRONG	18	53.94%	5	15.15%
ACTIVITY 3	**AIRBORNE SOUND PROPAGATION**			
RIGHT	15	45.45%	26	78.79%
WRONG	18	54.55%	7	21.21%
ACTIVITY 4	**MAGDEBURG HEMISPHERES**			
RIGHT	16	48.48%	29	87.88%
WRONG	17	51.52%	4	12.12%

Table 1. Results by activity developed

The results obtained when evaluating the students' answers in the pre-test and post-test process allow us to establish relevant information regarding the use of the group strategy called research in the laboratory and of the didactic technique, question-answer in the teaching-learning process of the concepts related to the vacuum and to verify its effects, information that will allow us to guide the establishment of a proposal of didactic innovation.

The successes obtained in a range between 1 and 33 of the tests and post-tests developed by the students were considered on the basis of an integer and its equivalent in percentages. Thus, the values of success in answering the questions of the first activity related to the effect of the vacuum on a balloon in relation to the pre-test and the post-test had a positive variation of 27.28% (Table 1), allowing to establish that the balloon inside the hood increases its volume due to the creation of the vacuum, and the effect of the homeostasis that the bodies have on the earth's surface can be modified in the absence of air.

For the second activity, the variation is 38.39 % (Table 1), it states that students do establish the difference between the concepts of boiling and boiling of water and that there is a way to generate boiling without increasing the temperature. The third activity has a variation of 33.34 % (Table 1), consequently, the students understand that the cause of not listening to the music inside the vacuum chamber is due to the absence of air inside the chamber since the sound is a mechanical wave. The fourth activity has a variation of 39.40% (Table 1), so they verify that the atmospheric pressure acting on any object on the earth's surface is present. It should be noted that the questions related to the Magdeburg hemisphere have the highest percentage of variation in correct answers (39.4%).

Finally, the average percentage of variation comparing the four activities together is 34.85 % (Table 2), showing that students improved their understanding of the properties that vacuum has on bodies. These statements can be better visualized in Figure 1, which expresses the variation of the hits in percentage of the pre-test and post-test.

QUESTIONS	PRE-TEST		POST-TEST	
RIGHT	14.75	44.70%	26.25	79.55%
WRONG	18.25	55.33%	6.75	20.45%

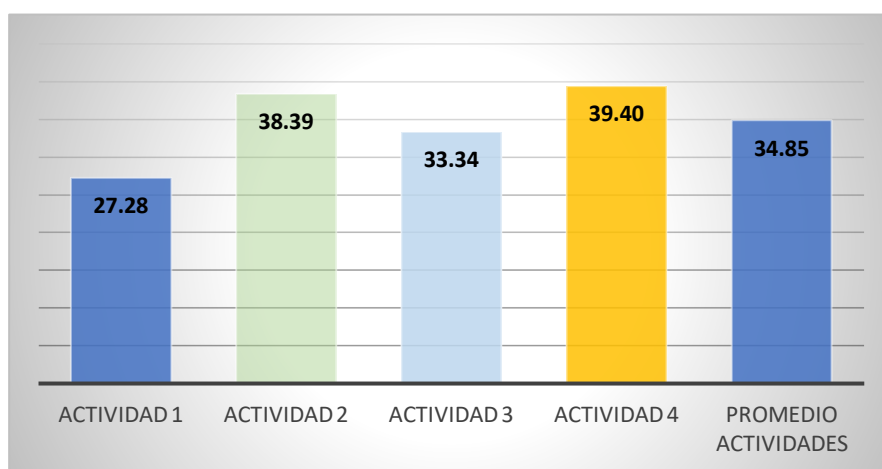Table 2. Average of the four activities developed

Figure 1. Variation of the increase in the percentage of right between the pre-test and post-test

5. Discussion.

The results allow establishing that the present proposal of didactic innovation to improve the understanding of the concept of vacuum and to verify its effects, using the didactic technique of questions and answers and the group strategy of research in the laboratory, does contribute to improve the teaching-learning process and therefore improve the processes of understanding the concepts studied in Physics.

For the questions addressed to the students, the multiple choice item format was used since, according to García (2006), this type of format allows "to evaluate a wide range of learning objects from factual to procedural knowledge" (p.21). Furthermore, this evaluation allows for objectivity, that is, it does not admit the interpretation of the answer

As Sánchez (2010) points out, "the use of questions in the university environment allows students to learn how to learn, promotes discussion of content, and maintains good interaction and participation during the class, which leads to significant learning" (p.22). These statements make it possible to establish that the process developed in this research is good enough to continue applying them in subsequent situations within the classroom.

As can be seen in Table 2 and Figure 1, the average percentage of students who correctly respond to the questions posed in each of the activities in the first moment executed in the

classroom through the pretest and later in the second moment developed in the physics laboratory through the post-test, increases from 44.70% to 79.55%. In this way, it can be stated that the use of the didactic proposal based on laboratory research and the application of questions addressed to students leads to the understanding of concepts related to vacuum.

Research carried out by Urbina (on methodological strategies to enhance the understanding of Physics allowed her to establish that work should be encouraged with the real and effective participation of students in the educational process, an assertion that has been corroborated by the present research allowing to establish the validity of this (Urbina,2008, p. 56)

Research carried out by Urbina on methodological strategies to enhance the understanding of Physics allowed him to establish that work should be promoted with the real and effective participation of students in the educational process, a statement that has been corroborated by this research allowing the establishment of validity of this.

In this research, unlike the ones carried out by Urbina 2008) and Sanchez 2017, it was carried out through practical activities, using the Physics laboratory equipment, making them more significant for the learning of concepts; therefore, the answers obtained when answering the post-test had a greater range of correct answers. For this reason, the feasibility of carrying out this activity in the classroom and complementing it in the physics laboratory on a regular basis can be considered, depending on the topics covered in hydrostatics.

6. Conclusions.

University teachers must develop new didactic proposals for learning that promote scientific, critical and reflective thinking towards physics in students, and one of them is that teachers must consider the need to pose questions to their students throughout the teaching-learning process carried out in the classroom and in the physics laboratory, in order to achieve an environment of constant work by the student. Moreover, this didactic strategy can be replicated in other institutions aligned in the field of higher education, in order to verify its validity with other groups of students and in other contexts.

Learning by asking questions contributes to improving the learning capacity and even more so the cognitive structure of the individual. To achieve this process, statements must be clear and understandable, allowing sufficient time for reading, understanding the question and selecting the answer.

It was possible to determine which work executed by students is effective in the educational process, allowing for the generation of truly significant learning processes.In addition, future research should consider how the use of information and communication technology influences the process of teaching and learning concepts related to the vacuum.

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Authors

FRANKLIN MOLINA-JIMÉNEZ obtained his Master's degree in University Teaching and Educational Administration at the Universidad Tecnológica Indoamérica (Ecuador) in 2011. He obtained his Bachelor's degree in Education Sciences, Mathematics and Physics Specialization at the Central University of Ecuador in 1995.

He collaborated as professor of Algebra at the University of the Armed Forces ESPE. Currently, he is a professor of Physics and Didactics of Mathematics and Physics in the Pedagogy of Experimental Mathematical and Physical Sciences Career at the Faculty of Philosophy, Letters and Education Sciences at the Central University of Ecuador. Its main research topics are oriented to the didactics of physics and flat geometry. First place in the

contest organized by the Secretary of Municipal Education of Quito and the Fidal Foundation in the category Tics applied to the process of teaching and learning, he is the author of chapters of books on physics and flat geometry, papers and articles published in several magazines.

LUCIA GOYES-CHULDE obtained her Master's degree in University Teaching and Educational Administration at the Universidad Tecnológica Indoamérica (Ecuador) in 2011. She obtained her Bachelor's degree in Science of Education with a specialization in Mathematics and Physics at the Central University of Ecuador in 1995.

She teaches physics and mathematics in public and private institutions and currently teaches Physics at the Calderón Municipal Education Unit. First place in the contest organized by the Secretary of Municipal Education of Quito and the Fidal Foundation in the category Tics applied to the process of teaching and learning. Her main research topics are oriented to the didactics of Physics.

Perspectivas de la producción científica en las universidades del Ecuador

Perspectives of scientific production in the universities of Ecuador

Jorge Balladares-Burgos

Universidad Andina Simón Bolívar, Quito, Ecuador

jorge.balladares@uasb.edu.ec

https://orcid.org/0000-0001-7033-1970

Ángela García-Naranjo

Universidad Central del Ecuador, Quito, Ecuador

aegarcian@uce.edu.ec

https://orcid.org/0000-0001-9299-8282

Cristina Granda-Villamar

Universidad Central del Ecuador, Quito, Ecuador

bcgranda@uce.edu.ec

https://orcid.org/0000-0003-3799-1365

Resumen

El presente artículo surge de la necesidad de conocer la situación de la producción científica en índices nacionales e internacionales de las universidades ecuatorianas desde el año 2003 al 2017. Estos índices revelan la desventaja de las universidades a nivel nacional e internacional. Las Instituciones de Educación Superior (IES) ecuatorianas se encuentran en puestos inferiores a nivel Iberoamericano (IBE), Latinoamericano y el Caribe (LAC) con respecto al número de publicaciones que han realizado. La investigación sobre los índices de creación científica de las IES del Ecuador permite vislumbrar el estado actual de la problemática. Además, en 2008 el Gobierno de Ecuador implementa una reforma de

Educación Superior para incentivar la creación científica. Por consiguiente, el propósito del estudio es analizar el estado de producción científica entre las diez mejores universidades ecuatorianas, a nivel nacional e internacional desde el año 2003 al 2017. Asimismo, determinar la influencia de la reforma de Educación Superior del 2008 en cuanto a la producción científica de las IES. La metodología empleada en esta investigación es de carácter inductivo-deductivo, apoyada en la revisión bibliográfica y la hermenéutica. Se concluye que en el período 2003-2013 la Universidad San Francisco de Quito publicó más contenido científico a nivel nacional mientras que en 2013-2017 fue la Universidad de las Fuerzas Armadas. También, se evidencia que las universidades subieron su producción investigativa a nivel IBE, LAC y nacional. Con estos datos se busca evidenciar los efectos de la implementación de políticas públicas que regulen la producción científica en las IES.

Palabras Clave
Escritura científica, índices, normativa, universidad.

Abstract
This article arises from the need to know the situation of scientific production in national and international indices of Ecuadorian universities from 2003 to 2017. These indices show the disadvantage of universities at the national and international level. Ecuadorian Higher Education Institutions (HEIs) are in lower positions at the Ibero-American (IBE), Latin American and Caribbean (LAC) level with respect to the number of publications they have made. Research on the scientific creation indices of HEIs in Ecuador allows to glimpse the current state of the problem. In addition, in 2008 the Government of Ecuador implements a reform of Higher Education to encourage scientific creation. Therefore, the purpose of the study is to analyze the state of scientific production among the top Ten Ecuadorian Universities, nationally and internationally from 2003 to 2017. Likewise, to determine the influence of the 2008 Higher Education reform regarding the scientific production of HEIs. The methodology used in this research is inductive-deductive, supported by literature review and hermeneutics. It is concluded that in the period 2003-2013 the San Francisco de Quito University published more scientific content at the national level, while in 2013-2017 it was the University of the Armed Forces. Also, it is evident that the universities raised their research production at IBE, LAC and national levels. With these data we seek to demonstrate the effects of the implementation of public policies that regulate scientific production in HEIs.

Keywords
Writing scientist, index, regulations, university.

1. Introduction
The level of scientific production refers to the ability of people, institutions and bodies that are part of society and disseminate information on some research on a specific topic. This research has been oriented as one of the academic activities that Higher Education Institutions (HEIs) must promote in their professors and future professionals. In recent years, research has been carried out on the number of scientific publications conducted in Ecuador by HEIs, revealing a poor development of scientific articles among Ecuadorian HEIs at national and international level; they have also denoted little contribution to the scientific field and the development of society. Castillo and Powel (2019) mention that this problem may be due to "the lack of scientific culture and appropriate policies that promote research, in addition to the lack of priority on research in universities" (p.1). In other words, the

country's lack of scientific output was due to the fact that there were no organisms regulating scientific research within the HIEs before 2008. It is also because the State did not allocate monetary funds to the research area. Finally, within HIEs, students and researchers did not have a research culture.

In 2008, the Ecuadorian State implemented the reform of Higher Education in order to try to increase the rates of scientific production at the universities. At the same time, it created a set of strategies and projects to improve research in the country. However, the impact of the reforms and strategies implemented with respect to scientific production has not yet been deeply studied. There are very few articles that analyze the number of scientific publications of Ecuador's leading HIE from 2003 to the present day. Therefore, it is necessary to conduct a thorough search of bibliographic sources that provide up-to-date and relevant information to the research to be carried out.

The reports published by SCImago Institutions Rankings (SIR) present the production and scientific contribution of HIEs at the Latin American, Ibero-American and Caribbean levels. As a result, concrete data on scientific production have been obtained with respect to HIEs in Ecuador. This ranking "offers a classification of institutions according to the number of jobs indexed in Scopus (...) based on three key factors: research, innovation and social impact" (SIR Iber, 2019, p.4). The research component has been used in this investigation, since it allows to know the number of scientific publications conducted by each university according to the periods mentioned in the report.

This component measures "the institutional capacity to generate scientific products and disseminate them through recognized channels of scientific communication" (SIR Iber, 2019, p. 24). However, one difficulty presented in the research process was that the data found in SIR Iber correspond to the scientific production of "Andorra, Spain, Portugal and Latin American countries" (SIR Iber, 2019, p.5); for this reason, it was necessary to extract only the information regarding the HIEs of Ecuador, taking into account the top ten universities in the country.

The problem of the poor scientific dissemination of the Ecuadorian HIEs has influenced the position they occupy at the Ibero-American (IBE), Latin American and Caribbean level and at the national level. According to Witter (quoted by Piedra y Martínez, 2007) scientific production is:

> The way in which a university or research institution is present when it comes to science; it is a basis for the development and a way of overcoming dependence between countries and regions in the same country; it is a vehicle for the improvement of the quality of life of the inhabitants of a country, it is a way of being present not only today, but also tomorrow (p.34).

Therefore, the situation in Ecuadorian universities before 2008 has prevented them from reaching relevant positions within scientific production at national and international level. On the other hand, the low level of research prevented higher education institutions from being part of the solutions to certain problems in Ecuador or worldwide.

Consequently, this article is relevant since it is intended to be carried out on the rates of scientific creation within the ten best Ecuadorian universities from 2003 to 2017. This will allow to know the role of Ecuadorian universities at the Ibero-American (IBE), Latin

American and Caribbean level and at the national level in the development and increase of knowledge that allows the improvement of society. The study on this problem helps to reveal new perspectives on changes in scientific production and reveals the impact of state intervention.

The intention of this research is to show that the scientific output of the top ten Ecuadorian universities has risen considerably in recent years, thanks to the reform and public policies established by the national government and the various regulatory and control bodies. The top ten universities, according to QS World University Rankings 2020 compared were: Universidad San Francisco de Quito, Escuela Superior Politécnica del Litoral, Pontificia Universidad Católica del Ecuador, Escuela Politécnica Nacional, Universidad Central del Ecuador, Universidad de Cuenca, Universidad de las Fuerzas Armadas, Universidad Técnica Particular de Loja, Universidad de Especialidades Espíritu Santo, Universidad de las Américas.

The purpose of this article is to analyze the state of scientific production among the top ten Ecuadorian universities, nationally and internationally during the periods 2003-2008, 2006-2010, 2009-2013 and 2013-2017 based on the results of SIR Iber. To this end, the idea is to find answers to:

- What was the number of scientific publications during the periods 2003-2008, 2006-2010, 2009-2013 and 2013-2017 of each of the ten HIEs?
- Which HIEs led the scientific production index during these periods?
- Was there an increase in the number of scientific publications since the Higher Education Reform?

It also seeks to determine the influence of higher education reform in 2008 on scientific creation.

Regarding the structure and content of the article, section 2 presents the concepts related to the research. Section 3 shows the review of the various bibliographic sources related to the scientific production of the universities of Ecuador. Section 4 specifies the methodology used to develop this research. Section 5 shows the results of scientific production of Ecuador's top 10 universities during the periods 2003-2008, 2006-2010, 2009-2013 and 2013-2017 based on SIR Iber results and scientific production before and after the 2008 higher education reform. Section 6 presents the conclusions in accordance with the results obtained.

2. Related concepts

2.1. Epistemological background of scientific production in Ecuador

From the origins of the university in Ecuador until approximately the year 2000, the Higher Education System has undergone several changes. The most significant with regard to educational quality arises in 2002 with the emergence of the Council for Evaluation and Accreditation of Higher Education of Ecuador (CONEA), which assessed the situation of scientific research and production within the HIEs in Ecuador. Epistemological horizons related to scientific production can be understood by presenting a brief review of the history of the Higher Education System in Ecuador.

The existence of a Higher Education System has its origins in 1596 with the creation of the University of San Fulgencio in charge of the Clergy, whose "main purpose was the education of the creoles" (Pacheco and Pacheco, 2015, par. 7). At this stage of the higher education system the priority was to educate people from prestigious and Spanish families based in

America. Back then, higher education was the privilege of few, and it was mainly aimed at the most aristocratic families of the country and those men who considered priesthood a way of life.

From 1822 to 1830 with the beginning of the Independent Republic, the University of San Fulgencio became the Central University of Ecuador (Universidad Central del Ecuador) and by 1869 the National Polytechnic School (EPN - Escuela Politécnica Nacional) was created, whose purpose was "to teach according to the practical and technical needs of the country" (Pacheco and Pacheco, 2015, parr. 8). This institution was founded during the presidency of García Moreno and was very well received as the first center of teaching and scientific research in the country. With the EPN, Ecuador would see the possibility of technical and industrial development.

After several years, at the beginning of the twentieth century with the advent of the Industrial Revolution, Ecuador changed its vision and sought the "incorporation of citizens into social production and development through the study of sciences, practice and research" (Pacheco and Pacheco, 2015, parr. 9). In the 1930s and 1940s, Ecuador issued the Higher Education Act which allows universities to become technically and administratively independent of the State. In 1998, Ecuador's Political Constitution was drafted, allowing neoliberal politicians to privatize access to third-level education.

After so many years of university history, in 2002 the National Council for Evaluation and Accreditation of the Universities of Ecuador (CONEA) takes office. This public entity, in accordance with the Organic Law on Higher Education issued in 2000, makes a first approach to the assessment of educational quality in Higher Education Institutions (HEIs).

2.2. Scientific production of Ecuador regarding the rules of control organisms of Institutions of Higher Education

The regulations seek to increase the scientific production, thus one of its policies is to determine that the resources of private and public universities are earmarked to develop research and disseminate the results. For example, Article 35 provides that institutions of the Higher Education System may additionally and preferably access the public resources for the pre-allocation for research, science, technology and innovation established in the corresponding law" (LOES, 2010a, p. 21); i.e. the state is committed to universities to provide financial resources that cover the costs of research projects. For the allocation of economic resources, the state will take into account the academic excellence assessment criterion evaluated by the CACES. According to this criterion, HIEs will receive between 3 and 10 % of the total amount.

In this law, universities also commit to allocate a percentage of the resources given for research publications. This is stipulated in Article 36 as follows:

> Allocation of resources for publications, scholarships for professors and research. Public and private higher education institutions will allocate at least six per cent (6%) in their budgets indexed publications, postgraduate scholarships for their professors and research under the national development regime. The National Secretariat for Higher Education, Science, Technology and Innovation will ensure the implementation of this provision (LOES, 2010a, p. 21).

This article highlights the economic incentives given to researchers and professors to perform their work, in addition to the responsibility of the National Secretariat of Higher Education, Science, Technology and Innovation so that this can be fulfilled. However, these are not the only sections concerning the scientific production boost, there are a number of articles throughout the Organic Higher Education Act that seek to promote the research. For example, to promote scientific programs in order to foster the development of the country.

The responsibilities given to higher education institutions with respect to scientific research in addition to the constant control of the State must rely on them. Thus, the Higher Education System must establish bodies to monitor the quality of universities. Article 353 states that:

1. A public body for the planning, regulation and internal coordination of the system and the relationship between its various actors with the Executive Function.
2. A public technical body for the accreditation and assurance of the quality of institutions, careers and programs, which may not be composed of representatives of the institutions subject to regulation (Constitución de la República del Ecuador, 2008a ,159).

Among the points that agencies will take to measure the educational quality of the third level of education will be the generation of research of each university, which allows the article to be executed. This is how agencies such as CACES, SENESCYT and CES are created to regulate Ecuadorian Higher Education Institutions. These will also implement standards that force universities to take scientific production as a priority work for the academic life.

2.2.1. Board for Higher Education Quality Assurance (CACES)

To ensure the quality of higher education, the State has promoted the establishment of bodies to evaluate, accredit and promote the quality of the Higher Education System (HIEs) in Ecuador. To achieve this end, the Board of Higher Education Quality Assurance is created (CACES).

This body established by the State began its functions in 1989 under the name of the National Council of Universities and Polytechnic Schools (CONUEP). CONUEP carried out the evaluation process, which concluded that "there is no higher education system in Ecuador [...] in the strict sense, but a set of university institutions independent of each other with certain cooperation at the administrative level..." (CONUEP 1992, p. 29, cited by CACES, 2018, p. 11).

After this evaluation process carried out by CONESUP, in 2002 this body takes the name of the National Council for Evaluation and Accreditation (CONEA), which undertakes a new process of evaluation and accreditation of HEIs from all over the country. In 2011, this body is named as the Council for Evaluation, Accreditation and Quality Assurance of Higher Education (CEAACES), which continued to carry out the processes of evaluation, accreditation and quality assurance of HEIs in the country.

Finally, in 2018 this body is called the Council for Quality Assurance of Higher Education (CACES), and according to the official website of the CACES (2019) it is responsible for:

Regulate, coordinate and plan participatory processes of accompaniment, evaluation, accreditation and qualification to ensure the

> quality in higher education institutions, focused on the balance of teaching, research, innovation and linkage with society (p.1).

Whatever the case, all the agencies have had the task of carrying out evaluation processes aimed at ensuring educational quality in all higher education institutions in Ecuador.

2.2.1.1. Higher Education Quality Assurance Council (CACES) Regulations on the Scientific Production of Higher Education Institutions

CONEA in 2002 (now CACES) began the process of evaluating the country's HEIs based on five criteria: academia, academic efficiency, organization, infrastructure and research. "The level achieved in the generation of scientific knowledge" was evaluated based on the research criterion (Pacheco and Pacheco, 2015, sec. The new Assessment and Categorization). In July 2008, the National Assembly of Ecuador issued the Constituent Mandate No.14 whose main objective was to commission the "CONEA to develop an assessment of the institutional performance of all the Higher Education Institutions (HEIs) of Ecuador in order to purge the system" (Rojas, 2011, p. 61). The results of the reports of Mandate No. 14 (2009) on the role of universities in the training of researchers show that:

> The research function is the weakest of the Higher Education System (SES), presenting itself as serious in private universities. In this way, the need arises to encourage the training of professors at the PhD level in order to achieve an improvement in the quality of higher education (Rojas, 2011, p. 61).

The results presented in the report allowed CACES to "generate institutional reflections and learning to improve the processes in its charge and respond to the country's current SES needs" (CACES, 2019, p.2), establishing a balance between teaching, research, scientific production, innovation and link with the society.

2.2.2. Secretariat of Higher Education, Science Technology and Innovation (SENESCYT)

The Secretariat for Higher Education, Science, Technology and Innovation (SENESCYT) is "the Ecuadorian Government entity that exercises public policy in higher education, science, technology and innovation" (SENESCYT, 2019, sec. The Secretariat). Likewise, it is responsible for governing "public policy in the fields of Science, Technology, Innovation and Ancestral Knowledge; it coordinates and articulates actions between the academia, research, public and private productive sectors" (SENESCYT, 2019, sec. The Secretariat). The Undersecretariat of Science, Technology and Innovation is within this institution, in which the Undersecretariats of Scientific Research and Innovation and Transparency of Technology are located.

2.2.2.1. Undersecretariat of Scientific Researh

The Undersecretariat of Scientific Research is responsible for managing the country's public policy of scientific research. On the website the responsibilities based on the scientific production can be observed, which are:

> b) Advise the General Under-Secretary for Science, Technology and Innovation on the definition of activities that promote the scientific research.
> c) Exercise the guiding of public policy for the scientific research.
> e) Approve, evaluate and finance the scientific research plans, programs and projects of this Secretariat.

> f) Validate and endorse the research projects proposed by the actors of the National System of Science, Technology, Innovation and Ancestral Knowledge.
> g) Accredit researchers and research institutions for the development of scientific activities in the country.
> h) Promote and articulate scientific research networks.
> i) Articulate the actors of the National System of Science, Technology, Innovation and Ancestral Knowledge for the production of scientific research (sec. Undersecretariat for Scientific Research).

The information highlighted above is related to the purpose of promoting scientific research in HEIs. For example, advising the Under-Secretary to promote scientific research and the approval of research projects are some of the relevant aspects that SENESCYT conducts for the development of scientific research within the country's HEIs.

2.2.2.2. Undersecretariat for Innovation and Technology Transfer
There are certain powers and responsibilities to be fulfilled by the General Under-Secretary for Science, Technology and Innovation. The one related to the country's scientific production is stated in section i) To follow up on scientific production, programs and research projects funded by the Secretariat.

These powers and responsibilities of each Undersecretariat belonging to SENESCYT arise from the provisions of the LOES, where in Chapter 3, COORDINATION OF THE HIGHER EDUCATION SYSTEM WITH THE EXECUTIVE FUNCTION, Art 182, literal g, is stablished that "from the national government, scientific and technological research policies must be created according to the development needs of the country, as well as the incentives for universities and polytechnic schools to develop them, without under-compliance with their domestic policies" (LOES, 2010a, p. 30).

The organization of this public entity has allowed a better development and fulfillment of the functions that it has as the rectory of public policies related to higher education. In this way, the legal framework governing the SES is complemented by complying with the constitution of the republic, as regards the bodies that must govern the Higher Education System.

2.2.3. Higher Education Council (CES)
The Higher Education Council or also known as CES is one of the agencies that govern the Higher Education System, and that has "as a mission the planning, regulation and internal coordination of the Higher Education System of Ecuador, and the relationship between its different actors with the Executive Function and Ecuadorian society" (Council of Higher Education, 2012, institution section). It is responsible for leading Ecuadorian universities through a series of regulations.

This institution approved in 2017 an academic regulation responsible for regulating academic degrees and everything related to it. One of the titles establishes a number of laws around the research activity. For example, Article 72 states:

> Research for learning. The organization of learning at each level of higher education training will be based on the relevant research process and will propose the development of knowledge and attitudes for the scientific, technological, humanistic and artistic innovation, as follows:
> 1. Research in higher technical education, superior technology and their equivalents. - It will be developed in the training of creation, adaptation

> and technological innovation, through the mastery of exploratory research techniques. Artistic careers should incorporate research into technologies, models and artistic production activities.
> 2. Research in higher education. - It will be developed in the framework of the training field of epistemology and the research methodology of a profession, through the development of exploratory and descriptive research projects (Reglamento de Régimen Académico, 2017, p.31).

The universities, careers and professors will have the responsibility to add to the program the research subject, in order to provide research tools to future professionals. In addition, it is a question of complying with the law that HEIs must generate science. The knowledge students receive on the development of research projects, types of research, methodologies, techniques, tools among others will help to increase the number of publications in the country. Therefore, the investigative task is prevented from being carried out superficially and for other purposes, such as accumulating documents rather than generating knowledge.

2.3.   University Reform in Ecuador

The arrival in the Presidency of the Republic of Ecuador of economist Rafael Correa Delgado in 2007 marked a before and after in the Higher Education System. In the years before 2007 "research was not part of the curricula, the few that were carried out responded to scientific concerns of professors and generally became a thesis of degree or doctorate" (Rivera-García, et al., 2017, parr. 6). The country's research reality was totally flawed and needed to be changed. The Higher Education model in Ecuador takes a turn in 2008 with the new Constitution of the Republic of Ecuador. In Title VII, Article 350 states that:

> The higher education system aims at the academic and professional training of students with a vision born from the sciences and humanities, so that it is based on scientific and technological research, innovation, promotion and dissemination of ancestral knowledge and cultures, depending on solving the country's problems, in relation to the objectives of the development regime (p. 162).

This provision promotes and requires higher education to be linked to the country's scientific and technological research. To achieve this, it was necessary to implement a new Higher Education Act, which took effect in October 2010. This new LOES in Article 13 determines the functions of the Higher Education System, including the literals:

> b) Promote the creation, development, transmission and dissemination of science, technology and culture.
> d) Strengthen the exercise and development of teaching and scientific research at all levels and modalities of the system (LOES, 2010, p. 6).

With the new vision of the Higher Education System raised in the Constitution of the Republic of 2008 and the Organic Law on Higher Education of 2010, it was necessary to propose a new legal framework governing higher education in Ecuador. This legal framework would be made up by the National Secretariat for Higher Education, Science, Technology and Innovation (SENESCYT); Council for Higher Education (CES) and the Higher Education Quality Assurance Council (CACES). The latter would be in charge of the evaluation and categorization of the Universities of Ecuador.

3.   Related works

In 2013, a seminar held at Escuela Politécnica Nacional presented a comparative bibliometric analysis of Ecuador worldwide and some universities in the country. The results show that until 2012 Ecuador has indexed with Scopus 3649 and on the Web of Knowledge 3573 scientific articles. On the other hand, the most prolific Institutions of Higher Education are Universidad San Francisco de Quito in the first place, Pontificia Universidad Católica del Ecuador in second place and t Escuela Politécnica Nacional in third place. The seminarian concludes that Ecuador needs a National Science and Technology Plan that motivates the production of projects and research to achieve a change in the productive matrix (Bruque, 2013).

In another research conducted in 2015, a comparison was made of Universidad San Francisco de Quito with other universities in Ecuador. The results awarded by Sir Ibero-America 2015 showed that the USFQ is the university with the highest number of scientific production, becoming one of the 200 most productive higher education institutions in Ibero-America. Finally, the author concluded that the USFQ provides 74.14% of high-ranking publications and that 82.89% are in collaboration with international institutions, revealing the prestige that USFQ is acquiring nationally and globally (DFCH,2015).

In 2015, a study on scientific research was developed in Ecuadorian universities, in which the author addresses one of the main problems of students at the national level and especially of higher education. The results of this research relate the Ecuadorian University with the government and the investment it makes for Higher Education Institutions. On the other hand, it is proposed that academic and scientific production is surrounded by prejudice. The study concluded that higher education must be truly changed, letting behind the American university model of the 1960s (Ayala, 2015).

In 2016, a research conducted a study on the perspective of the dissemination of knowledge of Ecuador at the national, regional and global levels. The results determined that Ecuador ranks 82 worldwide with 3 662 scientific documents, ranked 13th at the Latin American level. Finally, a comparison is made between the ranking of Ecuadorian universities with the highest number of indexed publications in the period 2009-2013. The list of five institutions of Higher Education with more numbers of articles is mentioned following the order:

1. Universidad San Francisco de Quito with 422 scientific articles in Scopus
2. Pontificia Universidad Católica del Ecuador with 319 scientific articles in Scopus
3. Escuela Politécnica Nacional del Ecuador with 152 scientific articles in Scopus
4. Universidad Técnica Particular de Loja with 143 scientific articles in Scopus
5. Escuela Politécnica del Litoral with 137 scientific articles in Scopus

Finally, the authors conclude that the trends at the national, regional and global levels demonstrate the importance that universities granted to research and the dissemination of results (Méndez, García and Ortega, 2016).

In a study in 2016, an analysis of the level of scientific production of the leveling professors of Universidad de Guayaquil was carried out until the first semester of the same year. The results confirmed that 42 professors, 28 men and 14 women, have published scientific papers, or 17.5% of the University's professors. Due to the problem encountered, the researchers conclude that it is necessary to systematize knowledge to achieve the development of multidisciplinary skills and multidimensional thinking of professors in order to generate innovations and new research (Reiban-Barrera and Vera-Cedeño, 2016).

A study presented in 2017 compared the number of scientific articles between Universidad Técnica Particular de Loja, Universidad Nacional de Loja and Universidad Politécnica del Litoral. The results determined that the UTPL has published 544 articles since 2012, UNL has published 102 scientific articles while Escuela Politécnica del Litoral has published 531 since 2011. Therefore, the author of this research concludes that there is a marked evidence of an increase in scientific production due to the investment that the Government made in Higher Education (Añazco, 2017).

The research presented in 2017 by the Cuban Journal of Higher Education analyzes scientific research in Ecuadorian universities as a priority of the current education system. The results of this research indicated that until the seventies Ecuadorian universities lacked the investigative component and although from the 1980s the Ecuadorian state promoted scientific research through various organizations, Ecuadorian universities were able to meet the expectations identified by the rupture between teaching and research. Therefore, it concludes that despite the changes generated in scientific research within universities, general development is not sufficient. In addition, there is no total understanding by all members of the Higher Education Institutions about the actions to be taken to increase academic production in their classrooms (Rivera-García et al., 2017).

In 2018, a research related to the scientific production of the Ecuadorian University is presented in order to know the scientific academic production in the universities of Ecuador and everything related to the training of research work in higher education institutions. The results indicate that scientific production increases when there are properly prepared professionals, also that research has managed to solve problems in the field of science, improving the performance of professionals related to the scientific production. Therefore, it was concluded that the increase in the scientific production in recent years was thanks to the intervention of some entities related to Higher Education (Cabrera et al., 2018).

In 2019, an analysis of the Scientific Production of the Universities of Zones 3, 5 and 8 of Ecuador is carried out. This study compared the scientific production of Universidad Estatal de Milagro, Universidad de Guayaquil, Universidad Nacional del Chimborazo and Universidad Estatal de Bolívar. The results show that in 2015 la Universidad Nacional del Chimborazo was the one with more scientific publications with a total of 84 documents, and by 2017 it maintained the first place with a total of 190 publications. This study concluded that scientific output had increased in 2017 at all universities in Zones 3, 5 and 8. (Pacheco et al., 2019).

4. Methodology

The steps used in this research are described below:

1. **Selecting the type of research of the methodology:** This research was exploratory, thus a thorough review of the literature related to the subject was necessary. This study handled an inductive-deductive qualitative methodology based on the use of hermeneutics for the interpretation of data obtained from the literature review.
2. **Selection of a representative sample of Higher Education Institutions:** 10 Ecuadorian universities were selected by taking into account the list provided by Diario El Comercio on the 15 best Ecuadorian universities according to the QS World University Rankings 2020. These higher education institutions were qualified based

on 8 criteria, which are: the institution's academic reputation, employer reputation, student-faculty relationship, the PhD staff, the international research network, citations for research, faculty research and the impact on the Internet (El Comercio, 2020).

The universities selected were: Universidad San Francisco de Quito, Escuela Superior Politécnica del Litoral, Pontificia Universidad Católica del Ecuador, Escuela Politécnica Nacional, Universidad Central del Ecuador, Universidad de Cuenca, Universidad de las Fuerzas Armadas, Universidad Técnica Particular de Loja, Universidad Espíritu Santo, Universidad de las Américas.

3. **Selection of bibliographic sources:** in order to know the number of scientific productions of the 10 universities, it was necessary to search for reliable data sources. Having reviewed several bibliographic sources, it was agreed that the data would be obtained from the 2010, 2012, 2015 and 2017 editions of the Ibero-American Ranking SIR. It is necessary to emphasize that each edition issued by the Scimago institutions ranking presents reports grouped in quintiles. Therefore, the periods taken into account for this study are: 2003-2008, 2006-2010, 2009-2013 and 2013-2017. These reports were taken thanks to the approximate sequencing between 2003-2017. Other reports did not allow compliance with the purpose of this study as they omitted important years and prevented proper sequencing of data.

4. **Comparison of Ecuadorian universities:** to contrast data between universities it was decided to draw up tables and graphs that helped to see the number of publications in a five-year period. In this way, it was observed whether there was an improvement or decrease in the number of scientific articles produced. It also sought to see some change in the position that the Higher Education Institutions occupied at the national, Ibero-American and Latin American levels. Finally, in order to establish possible development between universities, it was decided to compare the periods 2003-2008 and 2006-2010.

5. Results

5.1. Scientific productions indexed in Scopus in a five-year period

The Scimago institutions rankings (SIR) is the bibliographic source from which data was extracted on scientific publications produced by Ecuadorian universities in the periods 2003-2008, 2006-2010, 2009-2013 and 2013-2017. SIR (2010) "is presented as a tool for analysis and evaluation of the research activity of Higher Education Institutions in Ibero-America" (p.1). In other words, the reports presented make it possible to know the current situation of a country and universities with regard to the creation of scientific articles that help the development of a society. Data submitted for a five-year period can serve as benchmarks for the planning or implementation of possible solutions for the increase in the scientific production in a country.

Universities	Periods	2003-2008	2006-2010	2009-2013	2013-2017
Universidad San Francisco de Quito		200	318	422	836
Escuela Superior Politécnica del Litoral		3	71	137	730
Pontificia Universidad Católica del Ecuador		118	221	319	571

Escuela Politécnica Nacional	113	133	152	691
Universidad Central del Ecuador	50	59	103	348
Universidad de Cuenca	32	51	91	503
Universidad de las Fuerzas Armadas	0	19	53	884
Universidad Técnica Particular de Loja	17	53	143	732
Universidad Espíritu Santo	0	0	34	222
Universidad de las Américas	0	8	90	245

Table 1. Number of publications made by each of Ecuador's ten most representative Higher Education Institutions indexed in Scopus within the periods 2003-2008, 2006-2010, 2009-2013 and 2013-2017. Adapted from: (SIR, 2010,2012,2015 and 2019)

The first period taken into account is from 2003 to 2008. During this time, the SIR has compiled the number of scientific articles written by each of Ecuador's universities indexed in Scopus. For the preparation of the report, "scientific publications included in the Scopus citation index produced by ESLEIVER have been analyzed" (SIR, 2010). It is important to remember that the data presented in the ranking correspond to Latin America, hence to create the following figure it was necessary to extract only the information regarding the Institutions of Higher Education of Ecuador. Figure 1 shows the top ten universities in Ecuador and the number of publications they had in these years.
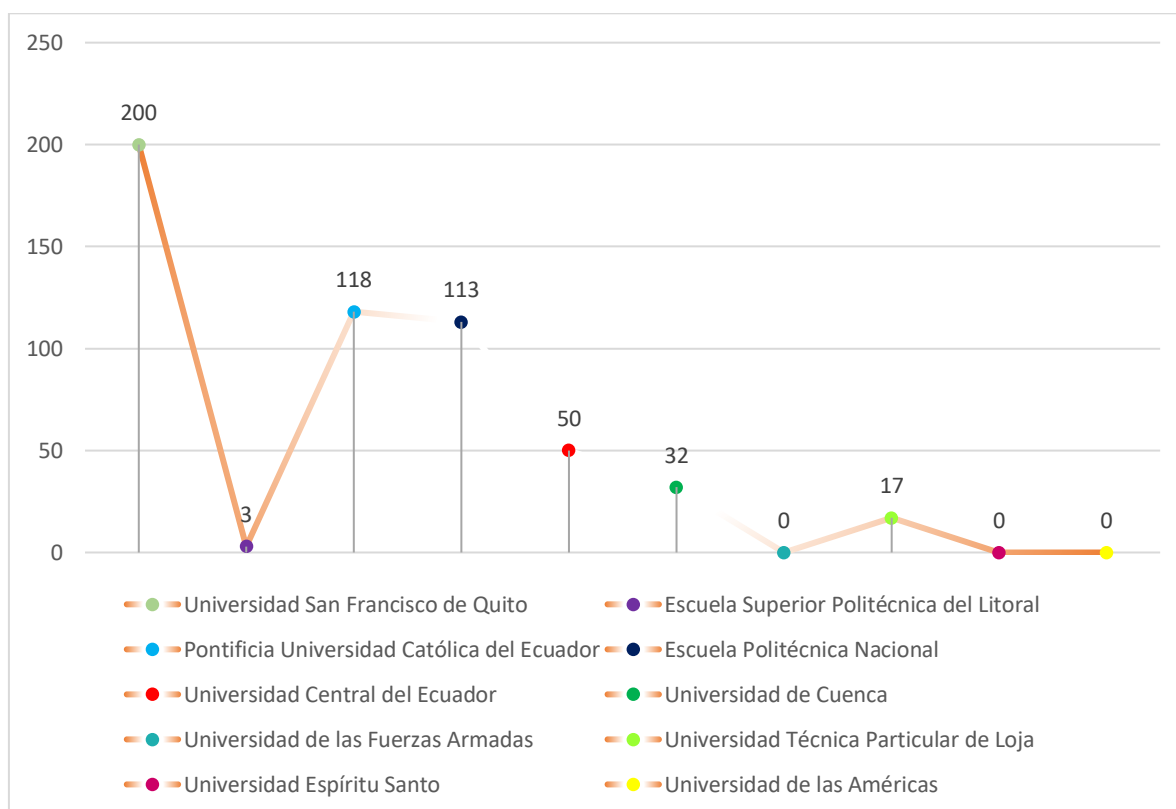

Figure 1. Number of publications in each of Ecuador's ten most representative Higher Education Institutions indexed in Scopus within 2003-2008.

After a careful observation of Figure 1, it can be contrasted that the three universities with the most publications in the period 2003 to 2008 were San Francisco de Quito (USFQ), la Pontificia Universidad Católica del Ecuador (PUCE) and Escuela Politécnica Nacional (EPN). USFQ ranked first with 222 publications, subsequently PUCE took second place with 118 publications and in the third place the EPN with 113 publications. As for the others, Universidad Central del Ecuador has 50 scientific articles, Universidad de Cuenca made 32 scientific articles, Universidad Técnica Particular de Loja 17 scientific articles and Escuela Politécnica del Litoral only 3 publications. While the Universities with zero scientific production were Universidad de las Fuerzas Armadas, Universidad Espíritu Santo and Universidad de las Fuerzas Armadas.

The second period taken into account is from 2006 to 2010. During this time, the SIR compiled the number of scientific articles written by each of Ecuador's universities. For the preparation of the report "all scientific production present in the Scopus database, prepared by Elsevier, 2016 has been analyzed in the period 2006-2010 and each publication and citation found has been associated with the institution or corresponding institutions" (SIR, 2012). It is important to indicate that the data presented in the ranking correspond to Latin America; to elaborate the following figure it was necessary to extract only the information regarding the universities of Ecuador. Figure 2 shows the top ten universities in Ecuador and the number of publications they had within this period.
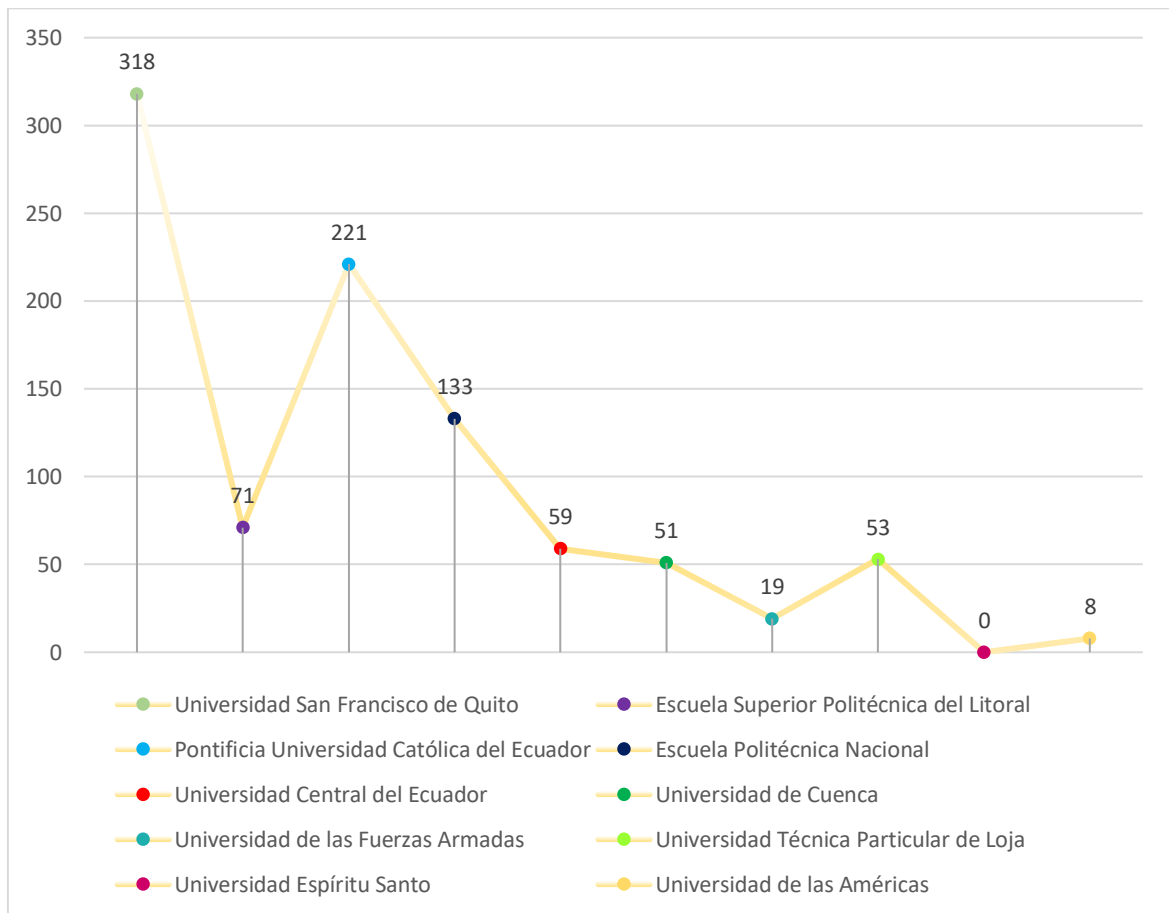

Figure 2. Number of publications by each of Ecuador's ten most representative Higher Education Institutions indexed in Scopus in the period 2006-2010.

In the figure above it can be contrasted that the three universities with the most publications during the years 2006-2010 were Universidad San Francisco de Quito, occupying the first place with a total of 318 publications, followed by Pontificia Universidad Católica del Ecuador with a total of 221 publications and Escuela Politécnica Nacional in third place with a total of 133 publications. On the other hand, the Higher Education Institutions with less scientific production were Universidad de las Américas with a number of publications equal to 8 and Universidad Espíritu Santo with a non-existent scientific production during this period.

During 2009-2013, the SIR compiled the number of scientific articles that have been written in each of Ecuador's universities. It is important to indicate that the data presented in the ranking correspond to Latin America, reason for which it was necessary to extract only the information related to the Institutions of Higher Education of Ecuador. Figure 3 shows the top ten universities in Ecuador and the number of publications they had within this period.

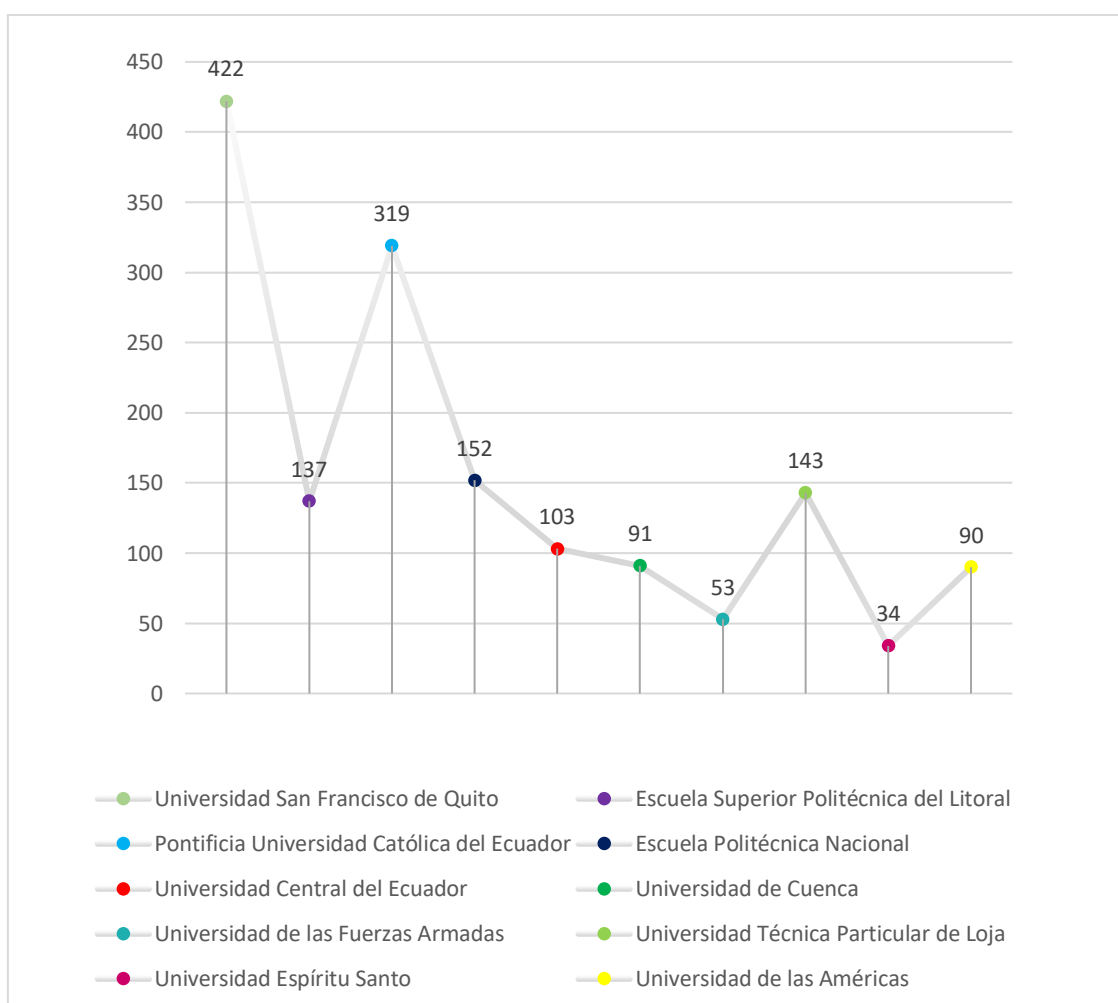Figure 3. Number of publications by each of Ecuador's ten most representative Higher Education Institutions indexed in Scopus from 2009-2013.

In Figure 3 it can be contrasted that the universities with the most publications during the years 2009-2013 were Universidad San Francisco de Quito occupying the first place with a total of 422 publications, followed by Pontificia Universidad Católica del Ecuador with a

total of 319 publications and Escuela Politécnica Nacional in third place with a total of 152 publications. On the other hand, the Institutions of Higher Education with less scientific production were Universidad Espíritu Santo with a total of 34 publications and Universidad de las Fuerzas Armadas with a number of publications equal to 53.

The last period taken into account for this study was from 2013 to 2017. During this time the SIR analyzes "the institutional capacity to generate scientific products and disseminate them through recognized channels of scientific communication" (SIR, 2019, p. 24). It is important to indicate that the data presented in the ranking correspond to all Latin America, thus it was necessary to extract only the information regarding the Institutions of Higher Education of Ecuador. Figure 4 shows the top ten universities in Ecuador with the corresponding number of scientific publications during the latter period.
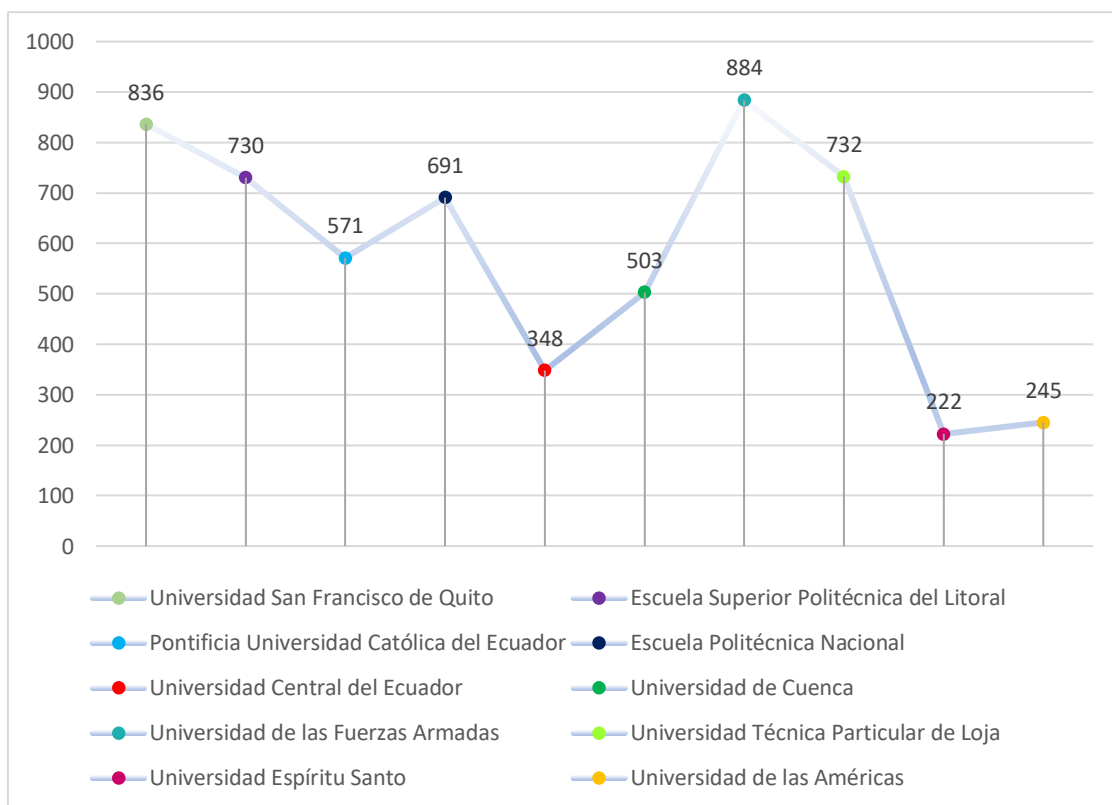

Figure 4. Number of publications by each of Ecuador's ten most representative Higher Education Institutions indexed in Scopus within the period 2013-2017.

In Figure 4 it can be contrasted that the universities with the most publications during the years 2013-2017 were la Universidad de las Fuerzas Armadas with a total of 884 publications, secondly, Universidad San Francisco de Quito with 836 publications and thirdly Universidad Técnica Particular de Loja with a total of 732 publications. On the other hand, it is also contrasted that the Universities with the least scientific production in this period were Universidad de las Américas with a number of publications equal to 245 and Universidad Espíritu Santo with a total of 222 publications in Scopus.

5.2. Ecuadorian universities according to their position at the national and Latin American level in a five-year period

Since 2009 SCImago Research Group publishes two types of reports: SIR world and SIR Iber. This latest report "shows the scientific activity exclusively of Andorra, Spain, Portugal, and Latin American countries" (SIR, 2019, p. 5). For the measurement of scientific production, SIR takes into account three aspects: research, innovation and social impact. The research aspect is intended to measure "the institutional capacity to generate scientific products and disseminate them through recognized channels of scientific communication" (SIR, 2019, p. 24). This scientific production capacity of each Higher Education Institution has allowed it to position itself within the ranking. Table 2 shows the top ten Universities of Ecuador during the periods 2003-2008, 2006-2010, 2009-2013 and 2013-2017 and the position they occupy at the Ibero-American, Latin American and national level.

Period	2003-2008			2006 -2010			2009-2013			2013-2017		
Universities	IBE	LAC	CO	IBE	LAC	CO	IBE	LAC	CO	IBE	LAC	CO
Universidad San Francisco de Quito	244	167	1	258	181	1	267	190	1	240	164	2
Escuela Superior Politécnica del Litoral	556	446	11	493	394	4	405	318	5	258	180	4
Pontificia Universidad Católica del Ecuador	291	205	2	305	224	2	304	222	2	291	207	6
Escuela Politécnica Nacional	297	211	3	392	303	3	394	307	3	263	183	5
Universidad Central del Ecuador	362	269	4	520	421	6	439	343	6	371	282	9
Universidad de Cuenca	399	300	6	552	449	9	439	352	7	305	220	7
Universidad de las Fuerzas Armadas	0	0	0	746	628	12	476	388	9	232	156	1
Universidad Técnica Particular de Loja	457	351	10	546	443	7	400	313	4	257	178	3
Universidad Espíritu Santo	0	0	0	0	0	0	405	406	11	434	342	11
Universidad de las Américas	0	0	0	938	808	17	504	415	14	421	329	10

Table 2. Position of each of the ten Institutions of Higher Education of Ecuador according to their scientific production in Scopus at the Ibero-American (IBE), Latin American and Caribbean (LAC) level and within the country (CO). Adapted from: (SIR, 2010, 2012, 2015 and 2019).

5.3. Scientific production before and after the Higher Education Reform of 2008

In 2008 in the mandate of Economist Rafael Correa Delgado, the country began a series of significant changes, as the so-called "Education Revolution", which proposed a radical transformation in the Higher Education System. Universities in Ecuador in terms of research and scientific production before 2008 performed poorly. Rojas (2011) says "the research function is the weakest of the Higher Education System" (p. 61). With the new educational model implemented in the universities of Ecuador, the component of research and scientific production in the Higher Education Institutions would improve markedly. Figure 5

contrasts the increase in scientific output of the country's top 10 universities before and after the 2008 education reform.
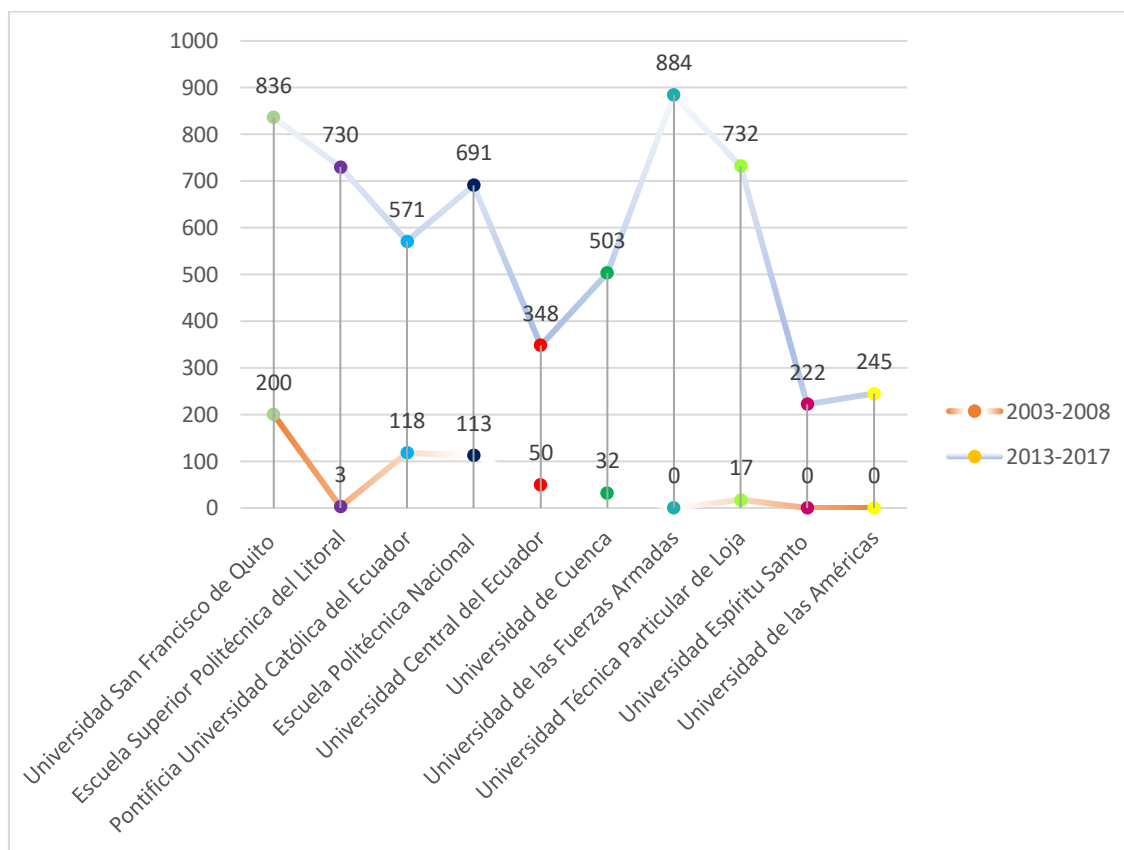

Figure 5. Comparison of the number of publications by each of Ecuador's ten most representative Higher Education Institutions indexed in Scopus between 2003-2008 and 2013-2017

Figure 5 compares the number of scientific outputs of Ecuador's most representative universities before and after 2008. During the period 2003-2008 the three universities with the greatest scientific production were Universidad San Francisco de Quito with 200 publications, Pontificia Universidad Católica del Ecuador with 118 publications and Escuela Politécnica Nacional with 113 publications. The increase in scientific production is contrasted with the results of the five-year period 2013-2017, during which these universities significantly increase the number of scientific publications. Thus, Universidad San Francisco de Quito makes 636 more publications reaching a total of 836 publications, Pontificia Universidad Católica del Ecuador reaches 571 publications and Escuela Politécnica Nacional reaches 691 publications.

On the other hand, the comparison of Universities with less scientific production during 2003-2008 were Universidad Espíritu Santo and Universidad de las Américas, both with a non-existent scientific production in this period. However, in the period 2013-2017 both universities increase their scientific production with a total of 222 and 245 publications in the Scopus database, respectively.

6. Discussion of the results

Figure 1 presented the number of publications by each of Ecuador's ten most representative Higher Education Institutions (HEIs) indexed in Scopus within 2003-2008. Based on these

results, it is observed that the number of publications of these universities is low. During this period, there were a total of 533 publications among the ten HEIs of which 431 publications belong to only three HEIs, such as Universidad San Francisco de Quito, Pontificia Universidad Católica del Ecuador and Escuela Politécnica Nacional. Moreover, scientific production during this period was not significant compared to the other seven HEIs, as seen in the data presented in Figure 1, the remaining seven universities did not reach 100 publications indexed in Scopus.

Figure 2 presented the number of publications made by each of Ecuador's ten most representative Higher Education Institutions (HEIs) indexed in Scopus during 2006-2010. During this five-year period, in 2008, the new higher education reform came into force and the scientific production began to increase in each of the HEIs. This statement is corroborated in Figure 2, because all HEIs except Universidad de Especialidades Espíritu Santo significantly increase the number of publications, as is the case of Universidad San Francisco de Quito that in this period indexed in Scopus 318 publications, i.e., with respect to the previous five-year period it increased a total of 118 publications.

Figure 3 presented the number of publications made by each of Ecuador's ten most representative Higher Education Institutions (HEIs) indexed in Scopus during 2009-2013. Based on these results, it is noted that the number of publications from these universities increased significantly compared to the previous five-year period. From the ten HEIs in Ecuador, only four Universities did not reach the hundred publications indexed in Scopus; however, they were significantly exceeded compared to previous periods. Among these Institutions are: Universidad de Cuenca, Universidad de las Fuerzas Armadas, Universidad de Especialidades Espíritu Santo and Universidad de las Américas.

Figure 4 presented the number of publications by each of Ecuador's ten most representative Higher Education Institutions (HEIs) indexed in Scopus during 2013-2017. Based on these results, none of the ten HEIs have fewer than 200 publications indexed in Scopus. It is also clear that Universidad de las Fuerzas with a total of 884 publications ranks first during this period, it is further confirmed that the 2008 higher education reform had a significant influence on scientific production, since this HEIs in the five-year period 2003-2008 did not have any publication indexed in Scopus.

Figure 5 compared the number of publications by each of Ecuador's top ten Higher Education Institutions (HEIs) indexed in Scopus during the periods 2003-2008 and 2013-2017. This comparison was made in order to determine whether the 2008 higher education reform had a significant influence on the scientific output of each of Ecuador's HEIs. Based on the results, it is observed that this reform had a positive and significant impact on the scientific production of these HEIs. This statement can be corroborated by looking at the data of Universidad de Especialidades Espíritu Santo (UEES), Universidad de las Américas (UDLA) y la Universidad de las Fuerzas Armadas (ESPE). These HEIs in the period 2003-2008 were not listed in the SIR Iber as they had a scientific production equal to zero. This reality changed during the period 2013-2017, as Universidad de las Fuerzas Armadas ended up positioning itself first with a total of 884 publications, displacing Universidad San Francisco de Quito. As regards the UEES and UDLA their scientific production increased, and for this period the number of publications would be 222 and 245, respectively.

7. Conclusions

The data revealed that during the period 2003-2008, 2006-2010 and 2009-2013 the leading universities in scientific production indexed in Scopus were Universidad San Francisco de Quito, la Pontificia Universidad Católica del Ecuador and Escuela Politécnica Nacional. On the other hand, Universidad Espíritu Santo and Universidad de las Américas were the Higher Education Institutions that reflected significantly poor scientific output during these periods. Finally, during the years 2013-20017 the universities with higher scientific production vary in relation to previous periods. Thus, Universidad de las Fuerzas Armadas positions in number one, followed by Universidad San Francisco de Quito and Universidad Técnica Particular de Loja. Howeer, Universidad Espíritu Santo and Universidad de las Américas remain as the Higher Education Institutions with lower scientific production.

The number of publications indexed in Scopus during the periods 2003-2008, 2006-2010, 2009-2013 and 2013-2017 has not allowed Ecuadorian universities to position within the top 100 at the Ibero- American and Latin American levels. However, it has been evident that they have made progress within the ranking of universities established by SIR. Although Higher Education Institutions, such as Universidad San Francisco de Quito and Pontificia Universidad Católica del Ecuador have not changed their status even with the increase in publications. The remaining eight universities have risen dramatically on the list of Ibero-American universities. According to the latest results of 2017, the leading university in publications at the national level is Universidad de las Fuerzas Armadas, and then Universidad San Francisco de Quito.

With the new model of Higher Education implemented since the 2008 Higher Education reform, the scientific output of universities at the national level improved markedly. Thus, Universidad San Francisco de Quito moved from 200 publications to 636 publications registered in Scopus. Similarly, Pontificia Universidad Católica del Ecuador moved from 118 publications to 571 publications. Escuela Politécnica Nacional moved from 113 publications to 691 publications indexed in Scopus. As for the Universities with the lowest number of scientific publications before the 2008 reform are Universidad Espíritu Santo and Universidad de las América; however, these improved markedly from 2009, since 2017 they record 222 and 245 publications in Scopus, respectively. This data reveals further increase in scientific production, which means that more topics are addressed and that HEIs in Ecuador are involved in the generation of scientific knowledge.

Acknowledgment

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Authors

JORGE BALLADARES-BURGOS is currently a lecturer and researcher at Universidad Andina Simón Bolívar –Ecuador. He holds a PhD in Teacher Training and ICT from Universidad de Extremadura in Spain.

ÁNGELA GARCÍA- NARANJO is currently a sixth semester student of the Career of Pedagogy of Language and Literature of Universidad Central del Ecuador. In addition, she is studying English to obtain B2 sufficiency at the Center of Continuing Education of Escuela Politécnica Nacional.

CRISTINA GRANDA- VILLAMAR is currently a sixth semester student of the Career of Pedagogy of Language and Literature of Universidad Central del Ecuador.

Análisis de la producción científica del Ecuador a través de la plataforma Web of Science

Analysis of the scientific production in Ecuador through the web platform on science

Elking Araujo-Bilmonte

Pontificia Universidad Católica del Ecuador, Quito, Ecuador

earaujo@puce.edu.ec

https://orcid.org/0000-0001-9206-7883

Liceth Huertas-Tulcanaza

Universidad Central del Ecuador, Quito, Ecuador

lkhuertas@uce.edu.ec

https://orcid.org/0000-0001-6216-1238

Kenny Párraga-Stead

Universidad Central del Ecuador, Quito, Ecuador

ksparraga@uce.edu.ec

https://orcid.org/0000-0002-8177-2066

Resumen

El presente documento nace de la desventaja encontrada en la producción científica de Ecuador con respecto a otros países de Latinoamérica. El objetivo de esta investigación es reflexionar sobre la importancia de la producción científica para el desarrollo social, educativo y científico del Ecuador. La metodología usada en esta investigación es de carácter inductiva – deductiva y se apoya en la investigación bibliográfica utilizando el método hermenéutico. Se presentan los resultados obtenidos en producción científica de la plataforma Web of Science de los períodos 2006 – 2008 y 2015 – 2020 en Latinoamérica. Se

toman como referencia estos períodos para contrastar los registros de producción científica previos a la reforma universitaria en Ecuador en el 2008 con los actuales. De entre los resultados, se determina un incremento en la producción científica de Ecuador en el último período. Ecuador se encuentra en el puesto 7 de los 20 países analizados. Se concluye que Ecuador muestra un crecimiento en la producción científica al igual que los otros países. Sin embargo, aún existe una diferencia significativa con respecto a: Brasil, México, Argentina, Chile y Colombia. A partir del año 2008 se estableció un proceso de evaluación de las instituciones de educación superior que ha influido positivamente en la producción científica de Ecuador. Además, estas cifras se pueden mejorar cambiando el paradigma educativo para que la escritura científica sea tomada como un eje transversal desde los primeros años de educación formal.

Palabras clave

Difusión, Ecuador, investigación, Latinoamérica, publicación, Web of Science.

Abstract

This document arises from the disadvantage found in the scientific output of Ecuador in relation to other countries in Latin America. The purpose of this investigation is reflecting about the importance of the scientific output for the social, educational and scientific development of Ecuador. The methodology used in this investigation is inductive – deductive and it is supported by bibliographical research using the hermeneutic method. The results obtained of the scientific output from the Web of Science platform during the periods 2006 – 2008 and 2015 – 2020 in Latin America are presented. These periods are taken as a reference to contrast the records of scientific production prior to the university reform in Ecuador in 2008 with the current ones. Among the results, it is observed an increase in the scientific output in the country during the last period. Ecuador is in the 7th position among the 20 analyzed countries. It is concluded that Ecuador shows a growth in the scientific output as well as the other countries. However, there is still a significant difference with: Brazil, Mexico, Argentina, Chile and Colombia. Since 2008, an evaluation process of the Higher Education Institutions was established and it has positively influenced the scientific output of Ecuador. Furthermore, these numbers can be improved by changing the educational paradigm in which writing would be taken as a traversal axis since the first years of formal education.

Keywords

Dissemination, Ecuador, investigation, Latin America, publication, Web of Science.

1. Introduction

Scientific activity has increased and has generated the need to raise indicators for its measurement. Continuous monitoring of these indicators is important to improve countries' scientific policies and contribute to their development. Scientific production refers to the new knowledge generated and its dissemination. In this sense, there are databases, including Web of Science, that record these values and allow to analyze the situation of countries in terms of dissemination of research.

Latin America is a region that has different nuances in terms of research. Alvarez-Muñoz and Pérez-Montoro (2016) note that "these countries are developing and adapting to the evaluation and quality schemes that exist in other more advanced countries in the field of science" (p. 758). The above relates to variations in Latin American countries in terms of

academic production. In recent years, some of these countries have obtained an important international visibility.

From 2008, in Ecuador, through Mandate 14, higher education institutions (IES) entered an evaluation process that aimed to categorize IES to ensure the quality of education. The research was developed by taking the publications as an indicator. In 2014 CEAACES[1] states: "The scientific publications of IES professors and that, in principle, are supposed to present the progress and scope of their investigative activities" (p.143). This is why the number of scientific publications of professor is currently a factor that gives accreditation to the IES of the country.

With this background, academic production is important at the higher education level. However, it has represented a great problem due to the limited knowledge of teachers and students to make an academic and scientific production. In addition, "the assessment of the students´ criterion yields an Ecuadorian university fragmented by two gaps: democratic and technological" (CEAACES, 2014, p. 136). This refers to the shortcoming of the university administrative system and access to technological resources. These are obstacles to develop research in IES. For these reasons, strategies were proposed to mitigate these shortcomings and improve scientific production.

One of the main difficulties in this research paper was the shortage of information and monitoring of scientific production in the region. In addition, Cañedo-Andalia et al., 2010 mention that:

> In the least developed countries, a large number of scientific articles can be seen that are only recorded in nationally-covered databases and, in some cases, regional, whose fundamental purposes are very different from those of these international databases (p. 29).

Ecuador and other Latin American countries are growing and have been inserted into the world vision, but it is important that scientific production research is carried out at the national or regional level. This paper presents Ecuador's scientific production with respect to other Latin American countries according to the Web of Science platform, which stores information from important international databases. Spain uses mainly the Web of Science to measure its scientific output. There are also a limited number of studies that have taken as a reference the data from the Web of Science. However, a broader picture of related work is required to make a comparison and discussion of the extracted data.

The purpose of this paper is to reflect on the importance of scientific production for the educational and scientific development of the country, using the data obtained from the Web of Science platform. To this end, the answers to the following questions are sought:

- What is Ecuador's situation with respect to the other Latin American countries in scientific output according to the Web of Science?
- What changes have been made in Ecuador in scientific output since Mandate 14?

As for the structure and content of the document, section 2 introduces the concepts related to the subject. Section 3 provides the results from previous research or analysis. Section 4

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[1]CEAACES: Council for Evaluation, Accreditation and Quality Assurance changed its name to The Council for Quality Assurance of Higher Education (CACES) through the Organic Reform Law to the Organic Law on Higher Education that entered into force on August 2, 2018.

details the methodology used to develop this paper. Section 5 shows the results of the records obtained on the Web of Science platform. Section 6, presents the discussion of results through an analysis of the data obtained. Finally, section 7 presents the conclusions according to the results.

2. Related concepts

2.1 Epistemological background of the scientific output

Scientific production is considered to be the visible aspect of scientific knowledge or ideas, leading to a process of material construction of knowledge. "Scientific production (SP) is considered to be the materialized part of the knowledge generated, it is more than a set of documents stored in an information institution" (Piedra-Salomón and Martínez-Rodríguez, 2007, p. 33). In other words, scientific production is not just a documentary record of knowledge, but it can be considered a discipline that allows the structuring of knowledge and makes possible its dissemination. Although one of its functions is the documentary record of knowledge, the definition of scientific production is much more extensive.

Scientific production processes, although not recent throughout history, have seen an increase and improvement in recent years. It can be said that scientific production is immersed in the daily events of humanity.

> This phenomenon is linked to most of the events in which people are involved on a daily basis, thus its evaluation [sic], taking into account the result of research and innovation, is not a recent practice in the various discipline areas (Piedra-Salomón and Martínez-Rodríguez, 2007, p. 33).

Depending on the increase in scientific production, it is necessary to find new ways or tools that allow scientific information to become widely covered. "The rapid and dizzying development of science and technology has led to an unprecedented increase in literature, creating the need to seek new paths for the dissemination of scientific information produced" (Piedra-Salomón and Martínez-Rodríguez, 2007, p. 36). This speed creates the need to opt for different means of dissemination, where writing becomes one of the tools to disseminate knowledge through journals and articles, as well as webpages and forums.

Recalling that scientific production should be disclosed, the means by which the information is transmitted may be formal and informal. "The disclosure of the SP can be done through formal and informal channels of communication because what is sought is to transmit information..." (Piedra-Salomón and Martínez-Rodríguez, 2007, p. 36). Therefore, based on the above, the way in which scientific knowledge is shared and the medium it deals with comes to a second position because the transmission of knowledge is important.

Global scientific production rates have always been led by major powers. Since 2008, the production of scientific articles has increased on the Web of Science platform. According to UNESCO (2015) "between 2008 and 2014, the number of scientific articles included in the scientific citation index of Thomson Reuters 'Web of Science' platform increased by 23%, 1,029,471 to 1,270,425" (p. 3). Consequently, the number of articles registered on that platform increased by 240,954 over a period of approximately 6 years.

In Latin America, certain countries stand out in scientific production due to the intervention of organizations that promoted it.

> After the Second World War [sic] and under the funding and coordination
> of international agencies, mainly UNESCO, the main institutions of the

> current Science and Technology Systems (SCyT) of Brazil and Argentina were created, although it was in the 1960s and early 1970s that there was a real boom in the creation of institutions responsible for designing and promoting policies and instruments aimed at guiding and managing scientific and technological development (Santa and Herrero Solano, 2010a, p. 380).

In this case, it is observed that countries such as Argentina and Brazil have a historical contact with scientific production. Social conflicts in the last century allowed the promotion of scientific development even in Latin America. On the other hand, the momentum of international organizations such as UNESCO, as evidenced in the above quote, was a central pillar for the scientific production in these countries.

Scientific production is considerably reduced in Latin America due to the large number of problematic factors in these countries. These problems are repeated in every country in Latin America, thus complicating the production of academic articles.

Regarding the academic production of Latin America, Santa and Herrero Solano (2010b) state that "it is one of the regions with the greatest social and economic imbalance, a situation that moves into the field of scientific-technical production" (p. 386). In other words, social, political and economic conflicts directly affect the scientific output, causing the production in the region to be disparate. In addition, these problems create barriers that do not allow the scientific production rate to be increased. Due to these factors, the publication of academic articles in Latin America is reduced in certain periods of time.

Despite all these problems mentioned above, in recent years Latin America and the Caribbean have had an increase in the publication of academic articles and scientific production.

> However, it is noteworthy that the region has experienced the increase in the number of articles published in recent years ... in Latin America and the Caribbean 22,138 articles were published in Scopus in 1996, while this figure increased to 126,620 in 2015, an increase of 5.72 points, more than the increase experienced in the United States (1.82) or Canada (2.31) (Gerrero-Casado, 2017, p. 28).

In other words, the rate of publications, in terms of quantity and compared to US, has increased considerably over a 20-year period. All this data shows the increase in academic publications in Latin America.

2.2 Scientific production of Ecuador regarding the control guidelines of institutions of higher education

The Ecuadorian state is considered an emerging economy country, because Ecuador's economic stability is mostly sustained by oil exploitation and production. "Ecuador is a small economy country [...] which is making considerable efforts to locate on the map of quality knowledge-creating countries" (Álvarez-Muñoz and Pérez-Montoro, 2015, p. 578). The economic level and development of the country is an important factor influencing the production and dissemination of academic texts and scientific knowledge. Despite the economic and social difficulties experienced in the country and repeated in the other Latin American countries, it is important to maintain extensive scientific production that functions as a measure to solve these conflicts.

Over the next thirteen years after the end of the twentieth century, Ecuador has experienced a slight increase in the scientific production, rising in relation to other Latin American countries. Álvarez-Muñoz and Pérez-Montoro (2015) in their analysis in 2014 indicate that "Ecuador is ranked 12th in Latin America. During the period of analysis, the country has gone from contributing 0.39% of scientific output in 2000 to 0.63% in 2013" to the Latin American total (p. 578). Taking into account the above, the country has experienced an increase in its scientific and academic production.

This increase in the scientific production is influenced by the events in 2008 in relation to the constitutional reform that the country experienced. From this reform, special attention is generated to the relation and connection between the university and the society.

> CONESUP's2 limited treatment of solving the problems associated with the institutional and academic development of IES, together with the little interest shown by a large majority of IES in fulfilling their social responsibility, were apparently the triggers for questioning the university work by various social sectors that somehow justified the intervention of the government and the National Assembly when dealing with the Constitution of the Republic and the LOES, showing that the university reform in Ecuador did not originate from its base but, rather, from the social and governmental claim (Rojas, 2011, p. 60).

With regard to the above, the reasons for paying attention to the academic activities of national universities are evidenced. Likewise, it is possible to rescue that the idea of university reform originates to meet the needs of society and contribute to its growth.

According to these events, it is possible to say that the Ecuadorian State pays vital attention to university activities in order to generate a link between the university and the society.
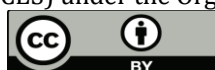
> Ecuador is in the process of accrediting universities to improve teaching and research processes. The need to provide dynamic answers to the environment requires that work is done on the design of participatory policies that help the university-society link move to higher degrees (Cedeño, 2014, p. 22).

In other words, the process of accreditation to universities has allowed the increase of the academic production in the country. In addition, it is said of an improvement in teaching processes. Education, in general, interferes with the country's academic development process related to the production of research and academic writing.

Another factor that has allowed this boost of Ecuador's scientific production has been, as mentioned above, the 2008 constitutional reforms. The Constitution of the Republic of Ecuador in article 351 states:

> The higher education system will be articulated to the national education system and the National Development Plan; [...] This system will be governed by the principles of responsible autonomy, co-government, equal opportunities, quality, relevance, integrality, self-determination for the production of thought and knowledge, in the framework of the

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2 CONESUP: National Council for Higher Education which was renamed as Higher Education Council (CES) under the Organic Higher Education Act of October 12, 2010.

> dialogue of knowledge, universal thinking and global scientific technological production (p. 60).

In this way, the Constitutional Reform of 2008 incorporates scientific production into the obligations of higher educational institutions. In addition, the university educational reality is linked to the entire educational system of the country, exposing the need for university academic processes to be linked with the society in general. These developments have resulted in an increase in the production of scientific knowledge and academic writing since 2008.

Within the theme of public policies immersed in academic processes, the Organic Law on Higher Education (LOES) plays an important role in the country's scientific production index. "In 2010, the Organic Higher Education Act (LOES) was enacted to promote research in universities" (Castillo and Powell, 2019, p. 11). Because of this, there is a clear interest in scientific research and production.

The LOES also shows a clear interest in teaching and the levels and percentages of publications that professors should have. "The LOES insists that all professors at the university level must have at least one master's degree and 70% of them must have a doctorate at research universities" (Castillo and Powell, 2019, p. 11). In this case, a requirement is raised to be part of the faculty at the university level. As a result, professors who do not have a doctorate must enroll in one and must generate scientific knowledge.

Similarly, the Secretariat of Higher Education, Science, Technology and Innovation (SENESCYT) is also considered a body in the area of scientific production at the level of higher education. To some extent, thanks to the policies stated by this state agency, the rate of academic publications has increased.

> Over the past few years, SENESCYT has started a product-based researcher accreditation policy, which encourages professors to update their credentials and increase publication rates to improve their employment opportunities and raise their salary (Castillo and Powell, 2019, p. 11).

Therefore, this increase in academic publications is related to the boost that SENESCYT provides to professors in order to improve their working and economic life. In this way, there is a need by professors to produce scientific knowledge and publish it. Initially, with the intention of improving lifestyle, determining the growth of the percentages at the national level.

2.3 Web of Science platform

The Web of Science (WOS) is a web platform of the company Clarivate Analytics that collects bibliographic references and quotations from scientific publications of any discipline of knowledge. "It was formerly known as ISI Web of Knowledge and was owned by the Institute of Scientific Information, and it was then acquired by Thomson Reuters" (UAM Biblioteca, 2019, Home tab). Therefore, it facilitates access to databases on appointments of academic documents. Its goal is to provide analysis tools to assess the scientific quality. Different databases can be accessed on the platform through a single interface, individually or multiple bases simultaneously.

> The WOS is composed of the core collection covering the Science, Social Sciences and Arts and Humanities indexes, as well as the Proceedings of both Sciences and Social Sciences and Humanities, along with the tools

for analysis and evaluation, such as the Journal Citation Report and Essential Science Indicators. In addition, it has the databases that complement it and that are included in the license for Spain: Medline, Scielo and Korean Citation Index (FECYT, 2019, Web Databases of Science section).

The platform has access to different databases in order to contrast information. Therefore, it can have a more neutral number of records and avoid repeating articles that appear in different databases. It also contains record data in all areas of knowledge. Thus, it is possible to find information regarding various topics.

The information collected by the platform is stored in collections of data. "The Web of Science Main Collection consists of ten indexes including information collected from thousands of academic journals, books, collections, reports and conferences, among many other sources" (Clarivate, 2019, Web of Science Help section). These indexes are: Science Citation Index Expanded (SCI-EXPANDED), Social Sciences Citation Index (SSCI), Arts & Humanities Citation Index (AH&HCI), Conference Proceedings Citation Index – Social Science & Humanities (CPCI-SSH), Book Citation Index – Science (BKCI-S), Book Citation Index – Social Sciences & Humanities (BKCI-SSH), Emerging Sources Citation Index (ESCI), Current Chemical Reactions (CCR-EXPANDED) and Index Chemicus (IC). Thus, it is a platform that contains quality information about the world's research process. These indexes help to improve the scientific production and therefore the development of humanity. In addition, the number of records show different types of publication or dissemination of research, generating figures that more accurately represent the level of science research and development in countries or regions.

3. Related works

In 2007, a research was carried out which aimed to define the rate of publications and scientific production in Latin America from 1975 to 2004 in the Web of Science, the results determine an increase in the total number of work in the region, with Brazil-Argentina partner dominating intra-regional bilateral collaborations. The authors conclude that scientific production figures at the Latin American level are constantly rising and gain momentum due to trends that exist globally (Russell et al., 2007).

In 2010, a research was carried out to analyze publication and visibility rates in the Latin American and Caribbean region for WOS databases compared to Scopus. The results show that smaller countries do not seem to grow, because national science coverage remains very limited. The authors concluded that there is an increase in the production and publications of scientific articles in the SCImago Journal Rank (SJR) indexed journal database in contrast to Journal and Country Rank (JCR) data, but this increase is not significant due to the recent publications (Santa and Herrero Solana, 2010a).

4. Methodology

The steps used in this research are described below:

1. **Selection of countries to carry out the comparative analysis**: The 20 Latin American countries were selected: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Puerto Rico, Dominican Republic, Uruguay and Venezuela.
2. **Selection of scientific production indicators:** The data were obtained from the Web of Science platform and the studied periods were: 2006 – 2008 and

2015 – 2020, due to the existing contrast of scientific production in the years prior to the university reform in 2008 with the present, and the databases: Web of Science Main Collection of Science, Current Contents Connect, MEDLINE, ScieELO Citation Index, Korean Journal Database (KCI) and Russian Science Citation Index.

3. **Comparative analysis of scientific production indicators during the period 2006 – 2008:** The analysis allows to determine the differences between the scientific production. Latin American countries were sorted in descending order according to the academic production and the number of records obtained from the Web of Science platform.

4. **Comparative analysis of scientific production indicators during the period 2015 – 2020:** The analysis allows to determine the differences between the scientific production. Latin American countries were sorted in descending order according to the academic production and the number of records obtained from the Web of Science platform.

5. **Comparative analysis of the scientific production in databases during the period 2015 – 2020:** Ecuador's position in scientific production with respect to the other Latin American countries was analyzed in each database of the Web of Science platform.

6. **Comparative analysis of scientific production indicators for the period 2006 – 2008 and the period 2015 – 2020:** The records obtained during the two periods in Web of Science are compared to identify the differences in Ecuador's academic output from the constituent reform issued in 2008.

5. Results

The Web of Science platform shows the scientific output of countries by taking into account the number of registers. The information submitted was retrieved on January 8, 2020. Table 1 presents the scientific production of Latin American countries during the period 2006 – 2008. Countries sorted in descending order are presented depending on the total number of records during this time. The data for Ecuador are highlighted in grey.

Countries	Scientific output during 2006 – 2008			
	2006	**2007**	**2008**	**Total**
Brazil	37773	44169	50352	132294
Mexico	16922	18643	20417	55982
Argentina	9383	10117	11608	31108
Chile	5861	6414	7264	19539
Colombia	4218	5148	6631	15997
Venezuela	2961	3134	3643	9738
Cuba	2161	2442	2685	7288
Perú	1178	1282	1413	3873
Puerto Rico	1145	1151	1398	3694
Uruguay	765	859	997	2621
Costa Rica	701	737	842	2280
Ecuador	430	479	560	1469
Panamá	392	466	500	1358
Bolivia	290	320	390	1000
Paraguay	183	178	189	550

Guatemala	115	135	146	396
Nicaragua	103	75	104	282
El Salvador	57	41	53	151
Honduras	49	38	56	143
Dominican Republic	6	9	8	23

Table 1. Scientific output of Latin American countries during the period 2006 – 2008. Source: (Clarivate, 2020, Advanced Search Section).

According to this number of Web of Science platform records, Brazil is the Latin American country with the most records during the period 2006 – 2008 (132294), followed by Mexico, Argentina, Chile, Colombia, Venezuela, Cuba, Peru, Puerto Rico, Uruguay and Costa Rica. Ecuador is ranked 12th on the list, showing 1.11% of Brazil's total number of records, followed by Panama, Bolivia, Paraguay, Guatemala,

Table 2 presents the list of countries sorted in descending order in terms of scientific production from the number of records obtained on the Web of Science platform for the period 2015 – 2020.

Countries	Scientific output during the period 2015 – 2020						
	2015	**2016**	**2017**	**2018**	**2019**	**2020**	**Total**
Brazil	81895	85656	91621	93510	89551	2564	444797
Mexico	31505	33532	35248	35260	32670	925	169140
Argentina	17219	17612	18217	18654	16484	486	88672
Chile	14321	15724	16284	17135	15886	358	79708
Colombia	14104	15205	17250	16112	13698	387	76756
Cuba	4468	4554	4652	4583	2927	61	21245
Ecuador	2428	3594	5088	5248	4332	126	20816
Perú	3301	3507	4243	4401	3946	89	19487
Uruguay	1965	2188	2390	2455	2253	58	11309
Venezuela	2501	2464	2436	2042	1555	31	11029
Costa Rica	1615	1914	1969	1917	1644	41	9100
Puerto Rico	1392	1791	1656	1514	1377	43	7773
Panamá	867	905	973	941	988	18	4692
Paraguay	409	526	637	605	623	18	2818
Bolivia	627	605	527	499	507	24	2789
Guatemala	373	364	454	382	391	3	1967
Nicaragua	171	177	240	212	169	6	975
Honduras	144	122	183	208	227	11	895
El Salvador	174	151	192	184	151	4	856
Dominican Republic	97	99	97	124	179	4	600

Table 2. Scientific output of Latin American countries during the period 2015 – 2020. Source: (Clarivate, 2020, Advanced Search Section).

According to this number of records, it is noted that Brazil is the Latin American country with the most records during the period 2015 – 2020 (444797) on the Web of Science

platform, followed by Mexico, Argentina, Chile, Colombia and Cuba. Ecuador ranked 7th on the list, showing 4.68% of Brazil's total number of records, followed by Peru, Uruguay, Venezuela, Costa Rica, Puerto Rico, Panama, Paraguay, Bolivia, Guatemala, Nicaragua, Honduras, El Salvador and Dominican Republic.

Table 3 shows the position of countries in scientific production for each database.

Position	Main collection of Web of Science	Current Contents Connect	MEDLINE	SciELO Citation Index	KCI – Korean Journal Database	Russian Science Citation Index
1	Brazil	Brazil	Brazil	Brazil	Brazil	Mexico
2	Mexico	Mexico	Mexico	Colombia	Mexico	Brazil
3	Argentina	Argentina	Argentina	Mexico	Argentina	Colombia
4	Chile	Chile	Chile	Chile	Chile	Argentina
5	Colombia	Colombia	Colombia	Argentina	Colombia	Cuba
6	Ecuador	Perú	Perú	Cuba	Ecuador	Chile
7	Perú	Ecuador	Ecuador	Perú	Venezuela	Venezuela
8	Cuba	Uruguay	Uruguay	Ecuador	Perú	Uruguay
9	Uruguay	Puerto Rico	Puerto Rico	Costa Rica	Paraguay	Paraguay
10	Venezuela	Venezuela	Venezuela	Venezuela	Panamá	Puerto Rico
11	Puerto Rico	Cuba	Cuba	Uruguay	Cuba	Ecuador
12	Costa Rica	Costa Rica	Panamá	Bolivia	Uruguay	Costa Rica
13	Panamá	Panamá	Costa Rica	Paraguay	Puerto Rico	Honduras
14	Paraguay	Bolivia	Paraguay	Panamá	Costa Rica	El Salvador
15	Bolivia	Paraguay	Guatemala	Puerto Rico	Guatemala	Dominican Republic
16	Guatemala	Guatemala	Bolivia	Guatemala	Bolivia	Nicaragua
17	Nicaragua	Nicaragua	Dominican Republic	Honduras	Honduras	Perú
18	Honduras	Honduras	Nicaragua	El Salvador	El Salvador	Panamá
19	El Salvador	El Salvador	Honduras	Dominican Republic	Dominican Republic	Guatemala
20	Dominican Republic	Dominican Republic	El Salvador	Nicaragua	Nicaragua	Bolivia

Table 3. Scientific output of Latin American countries in different databases during the period 2015 – 2020. Source: (Clarivate, 2020, Advanced Search Section).

According to the data obtained on the Web of Science platform, Brazil is the country in Latin America that has the largest number of records in the Main Collection of Web of Science (387464), Current Contents Connect (191285), MEDLINE (161923), SciELO Citation Index (90537) and Korean Journal Database (664), for which it ranks 1. Meanwhile, Mexico has more records in Russian Science Citation Index (85).

Ecuador, with respect to the other 19 Latin American countries, is ranked 6th in the Web of Science Main Collection records, 7th in Current Contents Connect, 7th in MEDLINE, 8th in SciELO Citation Index, 6th in Korean Journal Database and 11th next to Costa Rica, Nicaragua, Honduras, El Salvador and Dominican Republic in the Russian Science Citation Index.

6. Discussion of the results

With the data obtained in the results, the difference between Brazil, Mexico, Argentina, Chile and Colombia with respect to Ecuador is significant. Although the records obtained place Ecuador at number 7 on a list of 20 countries in the period 2015 -2020, this comparison has only been made in Latin American countries and not in Europe.

In relation to the databases from which the results were collected, Brazil stands out in almost all of them. However, in Korean Journal Database (KCI) and Russian Science Citation Index, Latin American countries show a low number of records, this is maybe due to a shortage of partnerships or collaborations with scientific research groups in these countries or researchers who talk these languages.

During the period 2015 – 2020, Ecuador ranks 6, 7 or 8 in the different databases obtained on the Web of Science platform, indicating that academic production is present in the different databases; thus, Ecuadorian scientific or academic publications are being disseminated or used in other researches worldwide and are part of international databases.

Finally, the comparison made on scientific production during the periods 2006 – 2008 and 2015 – 2020, indicate a considerable improvement of Ecuador, because it moves from position 12 to position 7. In addition, the growth rate for 2006 compared to 2019 is 907.44 %. It may be due to the reform on the accreditation of Higher Education Institutions in 2008 and by the impact of Information and Communication Technologies (ICTs) in all academic and research areas.

7. Conclusions

Academic output occurs mostly in the higher education institutions of countries as it represents a commitment to society. In this way, the research and dissemination of the results contribute to the social and economic development of countries.

Despite the economic, social and political conflicts experienced by Latin American countries, the rate of scientific output in recent years has increased considerably due to the changes or reforms of the government of each nation and the intervention of institutions that focus on the academic development.

Today, in the country's IES, scientific production and its importance has been more prioritized. However, there is a lack of knowledge about the production and drafting of academic texts by students, given by the Ecuadorian educational paradigm in which writing is not seen as a transversal axis in the formal education, and the results in higher education are not optimal.

Ecuador ranks 7th out of 20 Latin American countries according to the data extracted from the Web of Science platform. In Ecuador, there is little importance to scientific production. On the other hand, this research has only been carried out by comparing records in Latin American and not in Europe. Countries considered as first world have higher records in

scientific production and it would be important to make another study on this topic to analyze the situation of Ecuador on a global scale.

Ecuador has improved significantly in terms of scientific production at the Latin American level from 2006 to the present day. From 2008 on, a new mandate was established with regard to the accreditation of Higher Education Institutions. "The scientific publications of IES professors and which, in principle, are supposed to present the progress and scope of their research activities" (CEAACES, 2014, p. 143). The scientific publications of professors were then established as a fundamental factor in determining the quality of education. According to the results, these guidelines have positively influenced the scientific and academic development of the country, as importance has been given to research in all areas of knowledge and its dissemination.

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Authors

ELKING ARAUJO-BILMONTE obtained the master's degree in Educational Management and Leadership from Universidad Técnica Particular de Loja in 2014. He obtained his Master's degree in Hispanic Lexicography from the Association of American Language Academies in 2002. He obtained his Bachelor of Science degree in Education Sciences, specialization in Language and Literature from Universidad Central del Ecuador in 1998.

He is currently a research professor at the Faculty of Communication, Linguistics and Literature of Pontificia Universidad Católica of Ecuador.

LICETH HUERTAS-TULCANAZA obtained her proficiency certificate of in English at the Center for Continuing Education at Escuela Politécnica Nacional in Quito (Ecuador) in 2019.

She is currently a sixth semester student of the Pedagogy of Language and Literature at Universidad Central del Ecuador.

KENNY PÁRRAGA-STEAD is currently a sixth semester student of the Language and Literature Pedagogy Career at Universidad Central del Ecuador.

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