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REVISTA CÁTEDRA

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La *Revista Cátedra,* which belongs to the Faculty of Philosophy, Letters and Education Sciences of Universidad Central del Ecuador has been a means of communication since 1992; the academic voice of the professors was expressed through the bulletins, whose relevant objective was to improve the educational quality based on their experience, wisdom and knowledge as professors forming other educators. On May 2018, Revista Cátedra reemerges as a space that creates and disseminates articles oriented to the improvement of the educational process and its linkage with society.

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To disseminate multidisciplinary scientific unpublished articles, elaborated under the parameters of the research methodology, written with academic rigor and based on the teaching practice.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

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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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The Revista Cétdra has a quarterly frequency, and is published the first fifteen days of the first month of each period from January-April, May-August, September-December.

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- **Time for publication:** The periodicity of the journal is quarterly; therefore, editors are the guarantors of the fulfillment of time limits for revisions and publication of accepted works.

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Curriculum

REVISTA CÁTEDRA

EDITORIAL

The Cátedra Magazine is pleased to present volume two, number three 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, Physics and Curriculum.

The contents exposed in this new issue are characterized by being elaborated under parameters of the methodology of the investigation. In addition, they are built with academic rigor and based on teaching practice.

The issue consists of six approved articles:

The first article entitled *Social networks in universities of the country: Descriptive analysis and approach to a possible solution to improve the impact on academic activity*, by Esteban Gordon-Salcedo, Frans Noguera-Vásconez, Mario Morales-Morales and Santiago Morales-Cardoso. The manuscript presents a study on the current use of social networks by university students and the position of educational centers when incorporating these media into their academic plans. In addition, it analyzes the use of data from FanPages publications from three universities in Quito from user comments and reactions to these publications.

The second article entitled *Perception of educational actors about the use of mobile devices: A case study*, by Maldonado-Garcés Verónica, Balladares-Burgos Jorge and Rivas-Toledo Álex. The manuscript gives an account of the views of students and teachers in a public educational institution that has benefited from the Mobile Digital Classroom Project implemented by Fundación Telefónica within the framework of the Profuturo Project and coordinated with the Ministry of Education of Ecuador. The research determines the perception of both teachers and students with respect to the educational use of mobile devices.

The third article entitled *Android application to foster Kichwa language learning*, by Pilicita-Garrido Anabel and Cevallos-Duque Diana. The manuscript proposes the development of an application with Android operating system to establish an interactive learning guide of the Kichwa language in Ecuador. The purpose is to channel these technological guidelines to prioritize cultures, ancestral knowledge, customs and community values.

The fourth article entitled *Significant learning of luminance by the point-by-point method*, by Aulestia-Ortiz José, Vera-Macías Shirley, Mejía-Torres Nelson and Puga-Peña Luis. The manuscript describes the experimental process carried out to obtain the luminance of two types of lights, the incandescent and the fluorescent, in the same physical environment. The study chose the point-to-point method, which allowed to know the luminance in specific places of a surface under a light source located at a certain height. The results obtained determined the type of light that offers a good level of luminance and appropriate visual comfort, economic savings, easy to obtain and replace.

The fifth article entitled *Educational innovation and its impact on teachers*, by Páez-Granja Ruth and Martínez-González Ana Beatriz. The manuscript presents the analysis of the processes of change and innovation in education and their impact on teachers. The topic acquires particular relevance due to the fact that higher education in Ecuador is going through important processes of transformation that require a review of curricular content and teaching methodology, fundamental aspects that underlie any process of innovation or educational change. The work concludes with a body of recommendations that assume, among others, the need to involve teachers from the beginning in the processes of educational transformation through awareness, training and accompaniment programs.

The sixth article entitled *Curriculum redesigns in careers: an open dialogue in the Faculty of Philosophy, Letters and Education Sciences*, by Barreno-Freire Segundo, Borja-Naranjo Germania and Jaramillo-Jaramillo Cecilia. The manuscript identifies the perceptions of students and teachers about the difficulties of implementing the curricular redesigns in the Faculty of Philosophy, Letters and Educational Sciences of the Central University of Ecuador,

for which it was taken as a basis for analysis the substantive functions of higher education which are: teaching, research and linkage with society. The results showed that in the elaboration and implementation of the redesign there was limited participation of key actors, and there was also evidence of a deficient pedagogical and curricular orientation. One of the most important conclusions points to a comprehensive reform of the curricular redesigns of the careers that respond to the graduation profile in coherence with the pedagogical, epistemic, methodological and axiological guidelines of the Faculty.

Cátedra Magazine thanks all the authors and evaluators 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 specialties and educational levels.

Directors/Editors-in-Chief

REVISTA CÁTEDRA

Redes sociales en universidades del país. Análisis descriptivo y planteamiento de una posible solución para mejorar el impacto en la actividad académica

Social networks in universities of the country: Descriptive analysis and approach to a possible solution to improve the impact on academic activity

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Resumen

El uso actual que dan los estudiantes universitarios a las redes sociales, y la postura de los centros educativos al momento de incorporar estos medios a sus planes académicos, es el objetivo y fundamento que justifica este trabajo para que se analice el uso de la data que proviene de publicaciones extraídas de *FanPages* de tres universidades de Quito, además de los comentarios y reacciones de los usuarios a dichas publicaciones. La comparación entre el uso para lo académico y para el ocio es el principal eje que se examinó, mostrando sus resultados a través de gráficos y estadísticas. En base en este análisis se plantea un posible recurso basado en la tecnología de los *chatbots* para generar un mayor compromiso y fidelidad por parte de los universitarios hacia su centro de educación.

De la investigación realizada se pudo comprobar que los estudiantes buscan en las redes sociales generar experiencias y sentimientos, por lo cual interactúan más con las páginas de ocio que con las académicas. Ahí encuentran una cantidad de palabras y publicaciones que les permite identificarse y convertirse en un seguidor fiel, que tiene como característica principal, el compartir, comentar y reaccionar con la mayoría de los posteos.

Palabras clave

Academia, canales conversacionales, compromiso, ocio, redes sociales.

Abstract

This manuscript aimed to examine the use made by university students to social networks and the position held by educational centers when incorporating such means to their academic plan, being the latter the objective of this study in order to analyze the data based on publications taken from *FanPages* of three universities in Quito, in addition to comments and reactions by users of such releases. Comparison between the use for academic purposes and for leisure is the main parameters considered, and results were shown trough graphics and statistics. Based on such analysis, a possible resource was proposed, based on chatbots technology in order to generate more commitment and loyalty by university students to educational establishment.

It was found that students use social networks to generate experiences and feelings, for which an interaction is generated mostly with leisure websites in comparison to academic ones, where a great amount of words and publications are found, allowing to identify themselves and become a follower, whose main characteristics is share, comment and react with most of the postings.

Keywords

Social networks, engagement, academy, leisure, conversational channels.

1. Introduction

In this research other types of qualitative and quantitative data will be considered, thus forcing a different type of analysis for the collection of unexplored information. New technologies that have emerged for the analysis of unstructured information will be used in order to measure behavior and impact on students and to propose a possible solution that promotes academic knowledge using the network Facebook. This will be a huge advantage on the part of schools to impact positively on the students and make the most of the functions of booming social media by college students.

Taking as a premise the current state of knowledge, the hypothesis that the engagement (commitment) in the Academic *FanPages* by the university students of Quito does not exceed the third of the engagement generated by pages dedicated to leisure and entertainment.

The objective is to study the behaviors and expectations of the use of social networks by students from three known universities in Quito. The data will be collected from the *FanPages* of the universities selected and their peers dedicated to leisure; this data will allow to observe the use that the authorities and students give to this network. The comparison between academic and leisure use will be the main axis in this work, which will be presented in statistical results, and solutions that provide to university educational entities. The limitations that the work will have are that the data extracted for further analysis will be only from the social network Facebook. The data to be examined will be from the last three months.

This study is descriptive. Its objective is the identification of causes and evaluation of their effects so that it will allow to analyze the variables posed, control and measure any change in an efficient and orderly way. This study summarizes the most important elements and considerations that were developed in the thesis work of (Gordon-Salcedo and Noguera-Vásconez, 2018).

This document is structured as follows; the introduction contains the theoretical basis; the methodology describes each step taken in the research; the discussion of the results presents an analysis of the measurements found in the field and in the consultation; the conclusions summarize the findings as well as possible future lines of research.

1.1 Theoretical framework

1.1.1 General Concepts

- **Digital social networks**
  Among some authors, a digital social network is defined as a web environment, whose objective is to make it easier for people to establish relationships with each other, create communications, organize communities, and form sites with different content, with the main objective of sharing information from anywhere in the world, and anyone being a potential information creator (Bustos, Flores, and Flores, 2016). Young people have great knowledge in social networks and a willingness to use them for teaching purposes, in this way, they interact and have fun with them, they generate an academic value consolidating forms of cooperative study (Espuny et al., 2011). The study carried out by (Gómez et al., 2012) points out the main reasons for the use of social networks, and these are: general environment (friends, family) 75%, entertainment 61.8% and educative 24.7%.
- **Influence of social networks in the academic field**
  Despite the great potential shown by digital social networks, these can become a major threat if they are not given due use, as they can become a distraction for students and youth in general, in whom the average use for entertainment is 7 hours, reaching in many cases up to 14 hours (Bustos et al., 2016). Huang's analysis (2018) supports these arguments in which the correlation between the use of digital social media and student academic performance was calculated, and a very small negative correlation was found. All these factors are necessarily detracted during the study time for students, directly affecting academic performance; for these reasons, many universities have been reluctant to use social media in educational settings, claiming that they encourage leisure and that publications lack a good scientific basis (Rodríguez and Patricia, 2012). However, social networks have great

potential to improve cognitive and educational activities, using proper supervision by teachers (Bustos et al., 2016).

- **Analysis of social networks**
  Social networks offer the ability to find patterns and properties in user interactions to be studied in order to understand the relationship and behavior between the actors involved by applying some techniques use of networks and graphical theories (Dakiche et al., 2018). One technique for these studies is to identify how communities, or clusters are established, i.e., a high density of interactions between individuals in the same group and a low density of interactions between individuals from different groups (Leskovec et al., 2008). Another technique is content analysis, the characteristic that consists on giving information about unstructured data and the fluidity in the semantic text of publications (Antolín-Prieto, 2012), helping to establish predominant characteristics of messages to frame publications on different topics (Onieva, 2017).
- **Engagement.**
  The term *engagemen*t has evolved over the time, being a measure of the subsidy that exists between customers and the company (Erat, Desouza, Schäfer-Jugel and Kurzawa, 2006). While there is a wide variety of conceptualizations of this measure, many researchers agree that *engagement* is a state of mind, which leads a subject to focus on a brand or service and engage in frequent and ongoing interactions with the focus object, which go beyond making a purchase or transaction (Thakur, 2018). Its measurement is obtained by observing the degree of participation that users have towards the brand or service, whether consuming it, sharing it, publishing it, etc (Wagner and Majchrzak, 2007). This engagement is based on a collage of experiences, which are the beliefs a subject has on how he/she can adapt a website with his/her life (Calder et al., 2009). The high level of satisfaction generated by these experiences leads to the loyalty of the person, observed in the reacquisition, in the form of support or in the form of word of mouth propaganda (Anaza and Zhao, 2013). Another factor associated with customer engagement is trust in the company (Kim et al., 2009), which leads to user involvement not only to make an immediate acquisition, but to be in touch with the brand. According to (Achen, 2016) creating the engagemen*t* is important for obtaining information about the exchange of products and services of a particular company.
- **FanPages**
  These are pages that allow users to interact and affiliate with a brand, just as they interact with other private user profiles (Perez et al., 2018). Thus, people have a channel to follow their favorite brands, with the option to share and recommend their interests to their friends, because when a customer likes one of these pages, he/she already becomes a fan of it, and this information becomes visible in the user's profile. *FanPages* have an appearance of individual user pages, but have the unique advantage of sending messages quickly to a large number of followers, reason for which many companies use them as a business communication tool for constituting continuous dialogues with the customers (Kudeshia et al., 2016), which are being widely accepted, achieving a significant increase in sales for organizations (Pöyry et al., 2013).

1.2 Social networks and their apps

- **Education**
  The new global trend for education is MOOC (Massive Open Online Courses), based on collaborative interactions between all users while developing digital skills, with free access to all information and resources needed, without requiring classroom attendance, with the advantage that students will advance at their own pace and at the most appropriate times for each. Economically, these courses reduce teaching expenses by combining tutoring services with free online learning and social media. All this makes this new form of education very attractive to students all over the world. MOOC providers are: Coursera, edX, Udacity, FUN, Iversity, FutureLearn, Rwaq, Edraak, among others (Brahimi and Sarirete, 2015).
- **Marketing**
  Nowadays social networks have also positioned as ideal environments to publicize a brand, a service or a product by using the various features they offer, such as: the ability to upload information, the ability to share and publish written content or multimedia files, the ease they provide to create networks of people around the world, the customization of commercial pages to create a representation of their own identity (Gonzales and Hancock, 2010), and the ability to track user reactions with a product, thereby increasing the ability a business has to make decisions based on the results obtained (Herrera-Torres et al., 2017).
- **Artificial intelligence on the social media**
  One of the most important aspects in social networks is the establishment of conversational channels, interactions that are not only one-way but two-way, developing in the user a positive feeling towards service, brand or page (Onieva, 2017). To create these communication channels, new technologies can be used, such as virtual conversation agents based on artificial intelligence, which allow to create university environments conducive to communication between teachers, students and staff. Even today, the full potential of this technology is not exploited, but some success stories have already been carried out, such as the AgentSocialMetric tool, which helps the teacher to be aware of the current state of the classroom (Kuz et al., 2015).
  For the development of this tool they used a smart chatbot or chatbot software agent. A chatbot is a software that uses natural language to interact with users, thus simulating a human behavior based on models and patterns of dialogue of people to act as mediators in the distribution of cognitive tasks between machines and people. There have been several terms to refer to these programs, such as: virtual agent, chatterbot, dialogue system, among others. Today a wide range of chabots have been developed for many services and their use continues to increase (Ciechanowski et al., 2018).
  The conversational interface software agent used in this tool was one named Albert, who acts as a mediator in the relationship between the teacher and the students. Thus, the AgentsocialMetric tool manages to distinguish the questions of users and then elaborates the appropriate response, creating lines of collaboration and an excellent environment for the development of pedagogical works. An important feature of this tool is the possibility that the teacher can talk to Albert to extract information about the social climate of the classroom, thus finding profiles of students such as: the annoying, the leaders, the friends, among others. In this way, a comfortable environment for learning is developed. For future studies, it is intended to expand the methods of communication with the conversational agent, with channels suitable for people with visual disabilities, implementing audio functions to the chatbot (Kuz et al., 2015).

1.3 Case studies

Currently several analyses of the use of social networks in different fields have been carried out, such as: sport, academia, commerce etc. Below are some of these cases that set several examples for later studies.

1.3.1 Digital engagement and social identity of sport fans

The case of Premier League Teams on Facebook (Herrera et al., 2018). The objective of the study was to analyze the level of fanaticism by fans to the main *Fanpages* of Premier League teams, through the correlation between interactions and the page posts. The user interactions that were taken into account were: like, comment and share.

These three types of reactions, according to the study, indicate a different degree of commitment, for example, when responding to a post with a *Like*.

1.3.2 Use of social networks by Andalusian Public Universities. Content analysis of the official Twitter account (Onieva, 2017)

This study analyzed how Andalusian universities used social media to reach the public. Two types of audiences were established: internal (teachers, students, administrative and service) and an external audience (other companies, alumni, students seeking to enter the university and the public in general). To reduce the field of study, only Twitter official accounts of the universities were analyzed in the months of February 2014, 2015 and 2016. Similar to the study conducted on football teams, this study identified in each Twitter message the interactions by users, which would be the actions of: like, indicating a basic interest in the message, or retweeting, indicating the desire to make the message known to others.

Content analysis was an important aspect to establish the characteristics of messages that predominate in social networks by universities in the Andalusian region. It was observed that the most common topics were related with courses, conference information, conferences and open houses, and the topics less covered were about employment, student information, social and voluntary works, thus, confirming the communicative problem mentioned by (Paniagua et al., 2012) that universities have adopted Internet and social networks as means of information and have not emphasized communication with their students, professors and administrative staff. This study also advises that universities should consider the idiosyncrasies of each social network to establish their own themes, in order to better capture the attention and commitment of internal clients and post user-friendly content from each network and not send messages just by filling up with posts, which could even be detrimental to the page as mentioned by (Onieva, 2014).

1.3.3 Impact of social networks on the academic performance of students of Universidad de la Guajira (Colombia) (Martelo et al., 2017)

This study aims to find the influence of digital social media on the academic performance of university students. The methodology used is non-experimental, descriptive and transversal, conducted in a sample of 368 students from the first semester of Universidad de la Guajira in Colombia, in 2016. The analysis was based on a hypothesis test as far as sample ratios, comparing and obtaining variation in grades between two time periods; one by making use of social media, and the other without making use of these websites. As results it is noted that there is a great negative influence of social networks on the academic performance of students, results that corroborate the studies of (Junco, 2012). It could also be seen that the most commonly used social network is Facebook, followed by Twitter, Instagram and YouTube.

2. Methodology

This research is applied-type with a simple descriptive design and retrospective longitudinal cut; therefore, the design to be used relates time, action and audience, dimensions that help to conceptualize the process of study-impact research (Willet, 1974). By observing and measuring the incidence of the use and management of the FanPages of the universities to be studied, as well as the pages dedicated to leisure called MEMES, corresponding to each university center. The steps to follow are:

- **Sample selection and characteristics**
  Determine the ideal sample of publications to be examined, which allow to find trends, behaviors, characteristics and interactions made by students from the three most important universities in the country.
- **Definition and characteristics of the variables**
  Based on the current state of knowledge and the hypothesis stated, determine the variables and interactions necessary for the descriptive analysis of this research.
- **Choice and use of the support tool**
  Compare social media analysis and Benchmarking tools that facilitate data extraction and analysis.
- **Analysis and recognition of data patterns.**
  At this stage of research, the statistical variables of FanPages should be compared through filters, charts, tables, to determine common traits that college students seek to interact and become Fans.
- **Possible solution for a better impact in the academic area**
  Once determined the traits and behaviors that allow to make greater interaction between students and FanPages, a prototype software is developed to improve and position the educational pages.

3. Calculations and results

3.1 Sample selection

The study group corresponded to the students belonging the three universities - public and private- with great significance in Quito: Universidad Central del Ecuador for being the university with the most history in Ecuador, Escuela Politécnica Nacional by being a benchmark of high academic level in the country, and Pontificia Universidad Católica del Ecuador for having the 71st place in the ranking of Latin American universities in QS *Latin 3American University* Ranking 2018. The total average of conglomerate people who would interact with all *FanPages* is about eighty thousand users between men and women, as seen in Table 1.

		Gender	
Name	Students	F	M
Universidad Central del Ecuador	65.259	38.133	27.126
Escuela Politécnica Nacional del Ecuador	9.114	2.734	6.380
Pontificia Universidad Católica del Ecuador	14.445	8.667	5.778

Table 1. Comparative table of universities and the number of students

The use percentage of these universities were taken into account for the selection of the social network to be studied, as seen in Figure 1. The network used for the research is the social network Facebook, by being in a very high range of acceptance among university students and because of the advantages it presents when extracting and classifying the data.

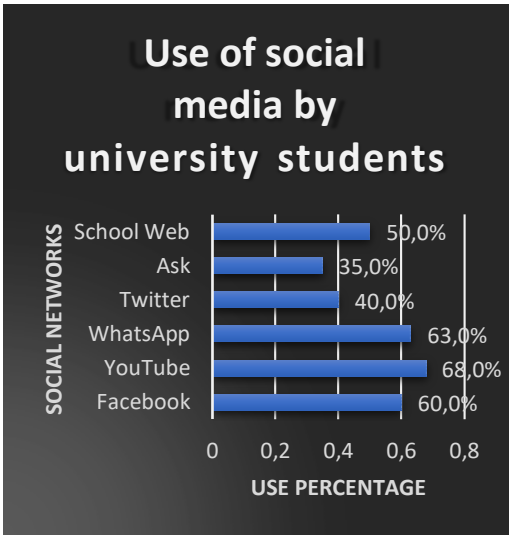

Figure 1. Use percentage of social media by university students (BrahimiySarirete, 2015).

3.2 Definition and characteristics of the variables

For the research, variables have been established to corroborate the statistics of the hypothesis, and were stated based on the case studies presented in the methodology, with guidance on the behaviors and trend of young university students when interacting on social networks (Facebook), grouping them into 3, presented as follows:

- **Independent variables**
  Those variables that allow to establish a direct relationship between the publication and the opinion of the students have been established in this group.
- **Digital interactions**
  These are the actions that can be performed on a post, comment, link, or video on Facebook, where the number determines how strong their engagement with the community has been, determining whether it was successful, or simply went unnoticed in the. Interactions have been classified hierarchically, as shown in

Figure 2, the most desirable being the option to share, followed by comments and reactions.

- **Dependent variables**
  Here the two main axes of research have been determined, being the union the universe of study to determine the behavior and use of young university students on Facebook, each being dependent on the interactions that are subjected posts made by their administrators. The groups are:

  - **Academic**
    This includes the official FanPages of each of the universities to analyze, where their objective is to inform and rescue remarkable news from their institutions, wanting to improve their image in the social sphere.
  - **Leisure**
    Emphasized in FanPages that perform a social critique through memes and generally humorous content, where their goal is to criticize the characteristics that define the other universities, such as the problems they have, being very volatile in time.

Figure 2. Relevance of interactions

- **Intervening variables**
  All variables that can interfere with the results have been defined, starting with the element that characterizes young university students, being a susceptible variable in time, called Emotion. The emotional, as an element that is emphasized in young university students, makes them feel identified with the options of digital interaction; therefore, there is space for fans or followers. The fans of those who tap Like to everything that a brand publishes, almost without further knowledge of the content of what has been published, because once it has won its emotions, digital interaction prevails impulsive; while followers keep watching each post waiting to be important to them, now, probably being a follower is probably the previous step to becoming a fan.
  A university student's age range varies from 18 to 35 years old and have been classified into three subcategories that are:

  - **Initial period**
    Those who take a propedeutic level, where the goal is to have a better image and adaptability with the group, letting themselves be greatly influenced bythe trends and opinions of the whole.

  - **Medium period**

Those students who are in the middle levels, having a better-formed criterion of everything that has been presented in their university career,defending and supporting their academy in each of the posts.

- **Advanced period**
  Those students about to graduate with trained characteristics, where their focus no longer depends on general opinions, where their intention is to learn in order to build their professional and educational career.

3.3 Election and use of the support tool

Choosing an optimal tool for the study to be carried out is essential, since the data obtained from it will be the basis of all the analysis. Several tools were compared to choose the most suitable for the study to be performed and it was determined to make use of the *Business Intelligence* (BI) tool for *Social Scan* of the company Golden Communications.

It has been selected for the ease it offers when recognizing and analyzing the social media metrics present on the Facebook pages of a company and its competition. The information can be presented in an intuitive and dynamic interface, since this tool automatically converts the data that has been extracted to statistical graphs for its best understanding. In addition, it has the functions of timelines, and *drill-down* and *roll-up* data filtration that provide a great help for information management, thus increasing the understanding of the results.

Social Scan allows to recognize and analyze the polarity in user comments and perform a content analysis on all posts that are required of a *FanPage*, which will be very positive when analyzing the behaviors of users and universities on the social network. The tool also provides great skill for real-time data extraction at high speed, saving time in data detection, extraction and visualization. And unlike other tools, it has local support in Ecuador.

3.4 Analysis and recognition of patterns in the data

With the definition of all the variables and with the help of the chosen tool, it has been determined to build a custom board, focused on each of the topics to be analyzed, emphasizing and determining what are the opinions, interactions and reactions that motivate people to have a better *engagement* of the main axes that are Leisure and Academic.

- **General Positioning**
  Due to the study of the aforementioned sample, the location of the FanPages to be studied has been embodied, observing in Figure 3 which of them generates more interaction in the social field.
  In the rating quadrant, it has been observed that the FanPageMemes UCE Quito has the largest number, approaching 60,000 of reactions, also exceeding 2,000 comments, compared to Memes PUCE and Poli Memes being in the first hierarchies of positioning, being relegated to the other official FanPages, with the observation that PUCE_Ecuador is approaching the OCIO group.

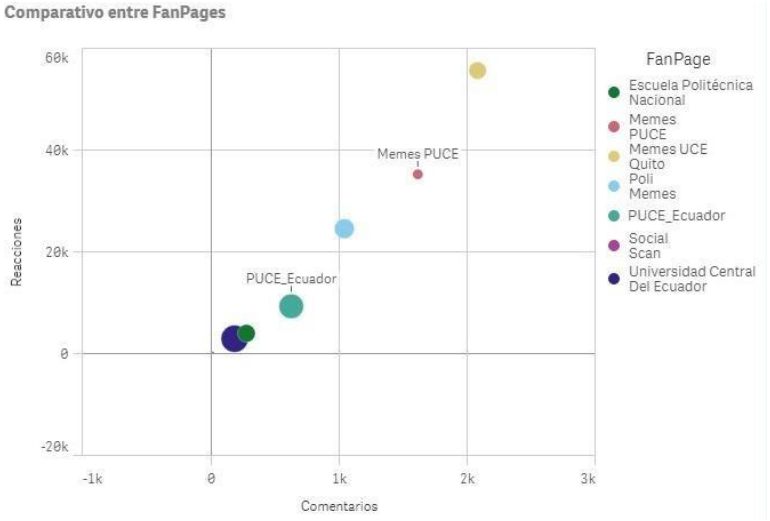

Figure 3. Positioning FanPages reactions vs comments

Based on this data a table was created showing the positions of FanPages by interactions with students establishing positions as shown in Table 2.

FanPage	N° of followers	N° of post	N° of shared	N° of comments	N° of reactions	N° of interactions
Memes UCE	40.274	140	10.540	2.079	55.745	68.364
Memes PUCE	14.427	140	28.368	1.613	35.355	65.336
Poli Memes	52.574	140	3.204	1.040	24.665	28.909
PUCE Ec	81.495	140	1.531	626	9.411	11.568
EPN	41.593	140	938	276	4.093	5.307
UCE	100.31	140	697	184	3.039	3.920

Table 2. Fanpages positioning sorted by interactions

- **Daily average publications**
  In order to perform a more detailed analysis, it was necessary to create new metrics, among which is the one that was called Daily Average Publication defined as indicated in Equation 1.

$$\frac{\text{Count(Feed\_Id)}}{(\text{Max(Date\_Post)} - \text{Min(Date\_Post)})}$$

Equation 1

Where it is clearly determined in Table 3 that the maximum number of daily posts is made by the FanPage Universidad Central del Ecuador, with more than 15 posts, and the one that publishes the least is Memes_PUCE, with a daily average of 0.12.

Name of the pages	Daily average posts
Memes PUCE	0.12
Poli Memes	5.19
Memes UCE Quito	0.34
Universidad Central Del Ecuador	15.56
Escuela Politécnica Nacional	4.83
PUCE_Ecuador	1.05

Table 3. Daily posts by FanPage

Among the content published by the *Official FanPages*, they have a more informative approach, being the most relevant publication among the three, the video made by *PUCE_Ecuador*, as seen in Figure 4. There is a lot of diversity of colors, motivating to leave a mark with the text of: *Celebrate every achievement obtained, revel in the built and make your mark with every step, that is to be of La Cato*.

Figure 4. Best didactic post on Facebook

It can be affirmed that *PUCE_Ecuador* is the didactic *FanPage* closest to the pages dedicated to leisure, where the texts express more colloquial phrases with the aim of allowing students to connect with the post.

3.5 Trend in the time

- **Leisure in time**
  Thanks to the tool, it has been mentioned what are the trends and interactions over the time generated by each of its Post, observing in Figure 5 the individual behavior in which each has its own color.

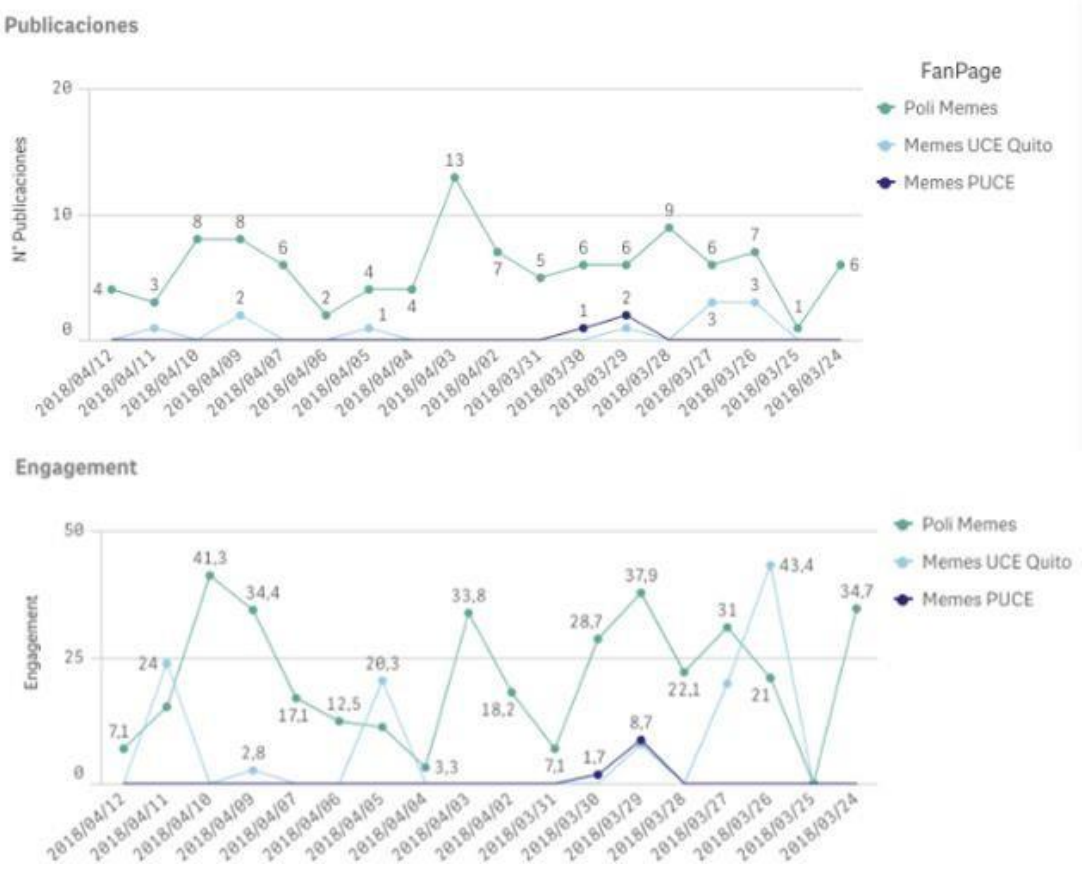

Figure 5. Leisure in time (April-March)

Poli Memes is the *FanPage* that publishes the most in the filtered days, generating an important *engagement* in the students, but it does not generate many shares, limiting itself to expanding and viralizing on the Social Network.

- **Academic in the time**
  Although there are more academic publications, exceeding 7 daily publications on average, Figure 6 shows that its engagement rate is low, reaching 12.6% and comparing engagement with respect to Leisure in most posts it exceeds 20%, having almost twice as much interactions with their users. This difference of almost 8 points reflects the inaccuracy and little creativity of academic pages when publishing their content, with certain exceptions that have already been mentioned above.

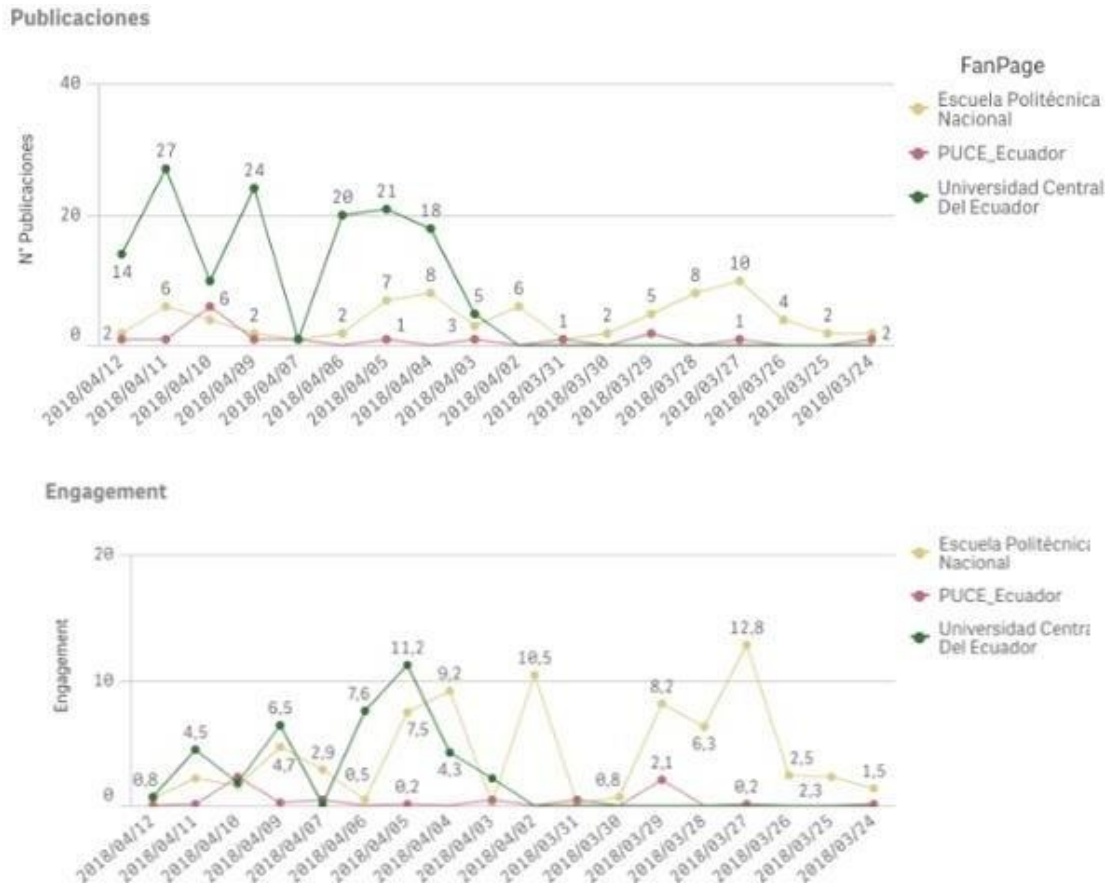

Figure 6. Academic in the time (April-March)

One of the visual forms provided by the tool is to observe all FanPages in a conglomerate way, for this analysis they have been grouped according to the dependent variables: leisure and academic. It was determined that the day where more posts have been generated by the Leisure FanPages is Tuesday; one of the reasons is the attenuation of the start of the week and the low pressure of the final tasks to complete the working days. It is noted in Figure 7 that the day with more Academic content is Wednesday, when examining its publications, it is evident the importance of announcing the events for future days over the following weeks or months, the idea is to consider that since Wednesday is a day that divides the week, it can attract more viewers.

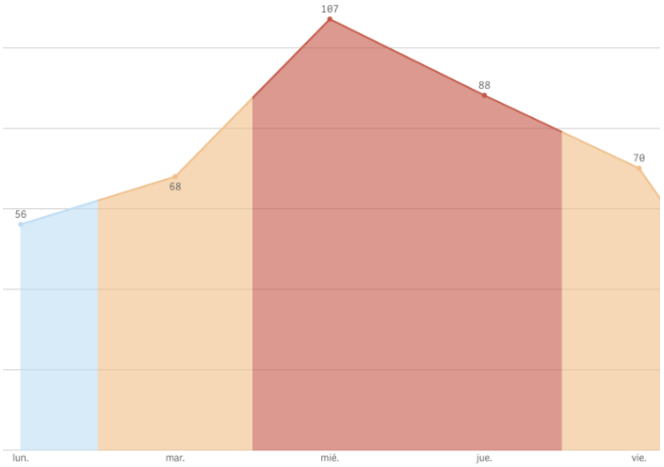

Figure 7. Days with more academic posts

- **Content strategy**
  To achieve a certain number of interactions, it is necessary to consider a strategy that includes a specific type of publication, as well as a day of the week that favors and increases engagement in followers or fans. The tool suggests that publishing video-type content on Fridays should be considered to ensure more shared numbers; however, after the ignorance of those who manage these FanPages, it has been determined that there is more publication incidence of photo-type content on Wednesdays, weakening the number of expected interactions.
- **Word detection**
  One of the key aspects for engagement is the appropriate use of language and linguistics, which facilitates the specific use of words in favor of captivating followers and fans. The words that are usually used are those that are trending and that can preferably be used in code or symbols, those that have a sarcastic language, or the fusion of a colloquial and indigenous language, as well as elegant words; the tool allows to determine those words that have been used the most and that have generated the greatest number of interactions.

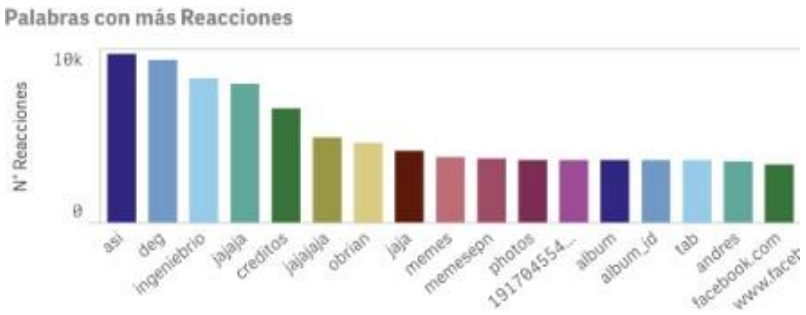

Figure 8. Most used words of leisure

In the long list that has been analyzed, in Figure 8 impact words are found in hierarchical order from the highest to lowest, such as: memes, vos, combats, engineering, key, etc., all with the same approach to grant confidence to their followers or fans to feel identified, accepted to become a member of a big digital community.

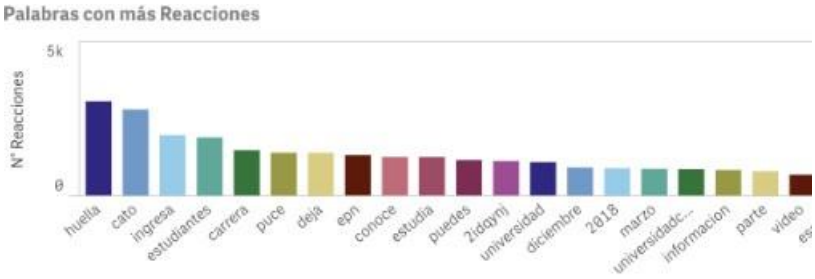

Figure 9. Most used academic words

On the other hand, in the pages intended for academics in Figure 9, relevant words have been found such as: information, study, students, enters, participates, knows, we invite, career, science, process, etc., where their interest is clearly informative, leaving creativity aside, becoming texts full of common words. It is worth highlighting the work that PUCE_Ecuador is doing by using more striking and colloquial words and phrases, such as: La Puce, la Cato, sowing, footprint, life, feeling, unique, generating an emotion in students, standing out in front of the other Academic FanPages, as it appeals to a much-needed sense of appropriation and identity in the university life.

Figure 10. Leisure analysis

It should be noted that leisure generates more than 4000 comments, most of which are done to defend and show the university where they belong, and at the same time discredit and mock the other Universities, as seen in Figure 10; there is 22.4% of negative comments where there is evidence of complaints and rude words. These kinds of defensive and even affective behaviors mark a convenience agreement even between followers and administrators to gain the attention of more followers or fans, through positive and negative discussions in the networks.

Figure 11. Academic analysis

Educational FanPages generate a small number of comments, and as shown in Figure 11 they are mostly neutral with 40% requesting more information in courses, trainings or events. The idea is to publicize the academic offer of the universities, and that a greater number of participants can be consolidated in the different activities.

3.6 Proposed solution for a better impact in the academic area

- **Sustenance for the proposal**

From the analysis made to publications, it can be observed that university students tend to respond in a more positive way to comments or phrases that are managed in a colloquial language with a common formal language in University posts. Funny texts are widespread among university students, and it should be noted that they can even contain very important information in them.

Content analysis also determined which keywords draw much more attention to young people, and which ones are not found in their lexicon. In addition, it was possible to determine that the videos and images are the content that generated the most interactions by the students.

From the current state of knowledge it can be mentioned that one of the very important aspects that generate positive feelings in users is the possessing conversational channels with interactions that are not only one-way but two-way (Onieva, 2017).

Tools that *chatterbots* have used for the educational environment have generated very positive responses, such as the *AgentsocialMetric* tool which manages to distinguish users' questions and then elaborates the appropriate answer to the sentence, creating lines of collaboration and an excellent environment for the development of pedagogical work.

- **Proposal**

Based on the results obtained in the analysis and the theoretical framework found, a prototype virtual conversational agent based on artificial intelligence was raised. As a first step, it was necessary to design a Facebook *FanPage* for the Central University of Ecuador, with the name *virtual didactic ECU* in which a *chatbot* developed with the online *Chatfuel* was deployed, providing many facilities when creating *chatbots*, especially for Facebook Messenger, because it has a block sequence for its construction, to which can be attached videos, images, audios, sequences, and even email *plugins*.

The aspects that were taken into account for the development of the *chatbot* were to answer common questions from college students and to provide information about relevant events at the University.

This *chatbot* will allow to obtain a two-way conversational channel, trained in understanding and answering questions expressed in a colloquial language that young people use and understand. In addition, the most popular words used in the lexicon of university students will be in the included in the questions and answers, to be able to interact with them in a friendlier and familiar way. Another important aspect is that the *chatbot* handles multimedia content (videos, audios and images) in its communication, thus generating more marked experiences and feelings in the users.

This software will serve as an impetus to develop in students a positive feeling towards the page, thus creating a university environment conducive to communication among teachers, students and staff.

4. Discussion

It is clear that *FanPages* generate great acceptance by users, and the degree of *engagement* depends on several factors that have been analyzed in this research, confirming the results of studies prior to this work that show a lack of skill on the part of universities to generate fidelity in students.

All these results have served as the basis for the structure of a possible solution, in order to ensure that knowledge is presented in a free, simple, pleasant and easy way for teachers and students.

The *FanPages* of the three universities analyzed have significant differences in the number of their followers, and in the same way they show that the level of interaction does not have a direct relationship with the number of followers, noting that the official *FanPages* of universities, despite having a significant number of followers, generate very little interaction. Positioning in the last places in the interaction table compared to leisure *FanPages*, which with few followers generates a lot of interaction.

Research has proved that the number of daily posts is not a determining factor in obtaining more interactions as discussed in the theoretical framework on the study of universities, contradicting a common and empirical knowledge that the more posts, there will be more interactions.

4.1 Topics of students for students in the social media

It is clear that young people have a high knowledge and use of social media, being currently a concern due to the great negative influence on the academic performance of students, but there is also a positive aspect in favor which is that young people have a great acceptance and willingness to use these social networks for an academic purpose. In addition, it can be stated that the most welcoming words are those with academic definitions fused with a burlesque touch, always with a focus on entertainment, the novel and colloquial. It is observed in the official *FanPages* of the three Universities their firm stance of governing in a formal state, where most of their posts are simple and mere informational ads that do not generate any attractive user experience, so that they feel unidentified, without the confidence and excitement to become a fan, while in the three *FanPages* of leisure, their criticisms of the academic, social and what is trending are done in a funny way, full of visual content with the aim of entertaining, leading the student to a state of mind that allows him/her to feel identified, reflecting many of his/her prospects or longings on the screen.

4.2 Social media in education

Today, the world's leading universities have chosen to structure a collaborative platform in which there is a global contribution by sharing knowledge among students and teachers, where courses are also taught, as in the *Mooc's* platforms. In the calculations and results, the

search engine words were course, homework, books, projects, etc, all of them related to the topic of education, noting that the official *FanPages* are reluctant to use social networks for educational purposes, limiting themselves to informational topics of little interest.

4.3 Response to publications

The comments on the leisure pages are 4 times more numerous than those made on the official pages of the universities. According to what is researched and proposed in the methodology, it is believed that this is because of the emotion of feeling identified, generating a mostly positive polarity unlike the officials, in which a neutral position is reflected to their publications by students.

4.4 Student behaviors on social media

Issues such as personal identity or the expression of the *self* are put at stake when the user defines himself/herself in being a fan or follower, because the university students, in the construction of an image of acceptance, allow themselves to be attracted by their tastes and affinities until even elaborate a *mask* that allows them to project themselves for fun rather than academic matters; therefore, the official pages of higher education institutions do not end up approaching the recognition of this way of digital interaction marked by the population of university students.

The behaviors will vary and will respond to their environments, contexts, ideologies, artistic attachments, but with a common aspect: *the emotional*. The uniqueness of the digital makes the user build his/her identity through a character that he/she can select, control with the mitigating of the *idealization* of himself/herself, since there is no such face to face encounter with the *other*; likewise, it does not respond necessarily at the simultaneous terms of the temporality of the *real* or physical world; therefore, these elements distance it from reality to such an extent that there is a risk of creating a virtual universe parallel to what would be called *real space*.

5. Conclusions

It could be observed that university students do not feel a real commitment to the official Facebook pages of their universities, while the *engagement* generated by their peers dedicated to leisure and entertainment is considerably higher.

It was possible to determine that audiovisual content is a great element when it comes to generating feelings and experiences, although not real in people's minds, thus, forging a solid *engagement* with the pages that use these resources.

Surprisingly, it was observed that the number of followers and posts of a *FanPage* is not a determining factor when conceiving interactions by users.

Finally, it was found that universities have used social media as simple means of publishing newsletters, something like a flyer board, thus ceasing to harness the full potential offered by these channels to capture the students' interest. Therefore, depending on the objective being pursued, it can be thought of a hybrid model that combines the two SQL and NoSQL technologies, where if greater consistency is needed it can be stored in a relational way, while databases would be used for immediate or recurrent queries.

6. Recommendations and future lines

Universities are encouraged to use graphic and audio elements in advertisements presented in their *FanPages* in order to generate more enjoyable and lasting experiences in students. There is a need to analyze different social networks in future studies, such as Twitter,

YouTube, Instagram, etc., in order to find greater features in the users, depending on the characteristics of each network. It is recommended to create more channels of two-way communication between universities and students, since it has been observed how they can enhance the relationships between the two destinations.

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REVISTA CÁTEDRA

Percepción de actores educativos acerca del uso de dispositivos móviles: un estudio de caso

Perception of educational actors about the use of mobile devices: A case study

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Resumen

La implementación de metodologías innovadoras relacionadas con el uso de recursos digitales ha permitido una participación relevante de las comunidades educativas. Este artículo da cuenta de las miradas de los estudiantes y docentes de una institución educativa fiscal beneficiaria del Proyecto Aula Digital Móvil ejecutada por Fundación Telefónica en el marco del Proyecto Profuturo y articulada con el Ministerio de Educación del Ecuador.

La investigación pretende determinar la percepción tanto de los docentes como de los estudiantes con respecto al uso educativo de dispositivos móviles. Se empleó el método inductivo, de manera que el punto de partida fueron los datos proporcionados por los 70 niños en edad escolar y 10 docentes para realizar la construcción de las categorías.

El 75% de los participantes de esta investigación asocian el uso del dispositivo móvil con el aprendizaje, refiriéndose además a un aprendizaje adquirido de forma divertida. Además, mencionan que la tableta les permite acceder a información, conocer otras culturas, posibilita la investigación lo que genera un aprendizaje significativo.

El dispositivo móvil dentro del aula ha logrado resultados positivos en los procesos de aprendizaje, la totalidad de los participantes perciben y valoran el recurso como positivo, lo asumen como un puente que les acerca al conocimiento de otras culturas, les da la posibilidad de investigar, de aprender valores, contenidos de asignaturas y de acceder a la lectura.

Palabras clave
Aprendizaje, dispositivos móviles, percepción, tabletas.

Abstract
The implementation of innovative methodologies related to the use of digital resources has allowed a relevant participation of educational communities. This article provides the views of the students and teachers of an educational institution benefiting from the Mobile Digital Classroom Project executed by Fundación Telefónica, part of the Profuturo Project and articulated with the Ministry of Education of Ecuador. The research aims to determine the perception of teachers and students in relation to the educational use of mobile devices. The inductive method was used, thus, the starting point was the data provided by the 70 children of school age and 10 teachers to perform the construction of the categories.

75% of the participants of this research associate the use of the mobile device with learning, also referring to the learning acquired in a fun way. In addition, they mention that the tablet allows them to access information, to know other cultures, to enable research, which generates significant learning.

The mobile device within the classroom achieved positive results in the learning processes, all participants perceive and value the resource as positive, they assume it as a bridge that brings them closer to the knowledge of other cultures, gives them the possibility to investigate, to learn values, content of topics and access to reading.

Keywords
Learning, mobile devices, perception, tablets.

1. Introduction
In the framework of the National Good Living Plan 2017-2021 and Ecuador's Nine Development Goals, Ecuador's Ministry of Education presented in 2017 the Digital Education Agenda (2017 – 2021) which aims to "strengthen and enhance the education-learning process in the National Education System through the increase of innovative practices that integrate technologies to empower learning, knowledge and participation" (2019, p. 2).

The Digital Education Agenda is based on a structure composed of five axes: Physical Axis, Axis of Digital Learning, Axis of Teaching Development, Axis of Communication and Promotion and Axis of Innovation. According to the Digital Education Agenda Approach, the fifth axis on innovation presents the mobile digital classroom as a pedagogical transformation project that looks for the insertion of technology into the classroom.

Based on these approaches, Fundación Telefónica, along with the Profuturo Proposal, implements the Mobile Digital Classroom Project in 70 public schools in Ecuador to benefit around 12,600 children and 2,100 teachers. Thus, it is meritorious to study the perception of educational actors about the use of mobile devices, in order to review whether teachers and students accept or reject the use of technology in the classroom.

In addition, another objective is to analyze the usability of resources in the framework of learning teaching processes. This topic becomes important when related to educational quality. The use of technology could be a decisive factor capable of achieving meaningful learning in education, reason for which the perceptions of teachers and students about the implementation of the Classroom Digital Profuturo Project have been analyzed. On the other hand, perceptions were categorized and these results were related between teachers and school-age students.

For the purpose of this study it is important to review the objective of the Mobile Digital Classroom Project, which aims to:

> Contribute to the acquisition of skills of children, through technology, and the empowerment of teachers for the implementation of innovative teaching methodologies (Telefónica Foundation, 2017, p. 1).

The public educational institution participating in this research received a set of technological resources from the Telefónica Foundation. These consisted of a computer, tablets, a charging hub, a Wi-Fi router, a mini projector and a strip. In addition, the Mobile Digital Classroom, through the tablet device, has several resources that students can access under the guidance of the teacher. The digital classroom offers a base of digital content and activities arranged on its platform: weclass.

Training and accompaniment to teachers and authorities of the schools where the project was implemented is an important axis in the implementation of the digital mobile classroom. Teachers received pre-implementation training of the project. Courses were conducted under face-to-face using the reverse class methodology and also the training was carried out through a virtual platform weclass.

All these actions occur in the area of digital learning. It refers to the new teaching and learning practices typical of the digital age. Its objective, for MINEDUC, is to develop critical thinking, creativity and prominence in solving life's problems in students and teachers. These strategies must be linked to the environment, using virtualized digital objects in a playful, visual and intuitive way. To make this possible, a decisive factor is the perception of teachers and students in the face of digital learning.

Perception is placed within the so-called basic psychological processes. According to Colmenero (2014), "perception is as a complex transformation of the effects that stimuli exert on our sensory systems on information and knowledge about the different elements, objects and entities of our environment" (2014, p. 46). From this, perception can be considered as one of the most important psychological processes, because it is at the basis of our ability to develop in the world.

The definition of perception has evolved over time. Various disciplines, such as Anthropology, Philosophy and Psychology have studied this topic. Perception is the cognitive process of consciousness that consists in the recognition, interpretation and

significance for the elaboration of judgments (Vargas, 2004, p. 48). It must be emphasized that when talking about perception, ideological and cultural references are involved that reproduce and explain reality, in this way they are applied to the various experiences of the regular basis.

2. Related studies

First, one of the studies carried out on the subject is that of Arancibia, Cosimo and Casanova (2018), which refers to one of the most recurrent perceptions of teachers in language on the use of ICT in the school context. They determined that these are important sources for teaching and for preparing the material. They also point out, as a result of the study, the facilitation of learning thanks to the use of tools such as videos, documentaries, power point presentations, hence, allowing to develop "playful" and "entertaining" classes. They also maintain the concentration and interest of students due to the closeness and naturalness with which digital natives use these technological tools in their daily lives.

Secondly, another study on this subject is the one published by the electronic educational research journal entitled "The Perception of the Usefulness of Technology conforms its use to teach and learn", study which concludes that technology is beneficial for achieving learning objectives, selecting curriculum content, organizing time and space for learning, and improving the quality of learning (Badia, Chumpitaz, Vargas and Suarez, 2016). It is important to clarify that the participants of the above study were teachers and the results were not correlated with the perception of the students.

Thirdly, another study on this subject is "Using Information Technologies in the Classroom" (Jaramillo, 2005). Children between 8 and 11 years old participated in this work. Evidence suggests that, in general, students when using the computer do not develop arguments around a topic, nor do they recognize the need for information. In the same way, they do not advance activities that facilitate the development of products to express their understanding on any subject.

Fourth, another study on this topic is the one entitled "Perceptions of Young People about the use of information technologies in the school environment" (Silva, Borrero, and Marchant, 2006), which points out an important result: students perceive that teachers do not value ICTs in the teaching/learning process, so they feel that they place restrictions on use in different subjects. This difference in vision means that technologies do not enter the school process and leads young people to establish different strategies for the use of ICTs.

The results of these investigations provide valuable information. The data show the perceptions of teachers and, on the other hand, of students in the university field. This study will provide data on school-age children and is also intended to categorize students' perceptions about the educational use of mobile devices and something useful is the possibility that this research allows to relate the perception of the teacher with the perception of the student.

3. Materials and methods

This study refers to the case of a regular educational institution that offers Elementary School. It is located in the historic center of Quito, capital of Ecuador. Its teaching mode of study is face-to-face.

This research is descriptive and qualitative type. The design is non-experimental with a descriptive cross-sectional type, because the aim is to examine the impact on students' and teachers' perceptions of the tablet use. The level of this research is descriptive as it seeks to characterize the impact of the use of tablets on teachers and students.

3.1 Participants

The students from this school who use the tablet in their learning process participated in this study. The population is composed of 160 children from the second to seventh year of Elementary School. The sample was made up of 70 children, 10 teachers and authorities from the educational community, who authorized the work with the above sample. The inductive method was used, so that the starting point was the data provided by children and teachers to carry out the construction of the categories.

3.2 Normas éticas de investigación Ethical standars of research

Informed consents were signed with research participants (institution managers, teachers and parents). The children signed an informed consent.

3.3 Instruments

Semi-structured interviews with teachers from the educational institution were conducted in this study, and focus groups were also created; however, emphasis was placed on the fieldwork with 70 children. 21 are in the fourth year of Elementary School, 26 children are in the sixth grade and 23 children are in the seventh year Elementary. The instruments used were validated by professionals in the field of Education and Psychology.

The children participating in this research make regular use of the tablets in the classroom during the approach of the different subjects and contents according to the official curriculum in force since 2016. These children actively collaborated in the proposed activity of handwriting a letter where they were asked to express their perceptions of the use of tablets. The children wrote freely with the slogan that the letter would be read by children from the Amazon region of Ecuador who did not yet know anything about tablets and their use in the classroom.

3.4 Data analysis techniques

An encoding of the data involving segmentation in topics was performed to place them in the different categories. As for these categories, they were determined from the analytical questioning and mental comparison of the different situations reflected in the data. Part of the process included an analysis of letters written by children to establish categories that encompass children's perception on the use of tablets in the classroom.

3.5 Procedure

Initially an interview was conducted with the highest authority of the Educational Institution to share the objectives of the research project and request an authorization to start the study. Subsequently, the focus group was conducted with the teachers who received training on the use of tablets in the classroom, in order to detect their perceptions, fears and expectations about the use of a digital resource during the classes.

Individual interviews with teachers were consecutively conducted with the aim of analyzing the pedagogical and didactic work they perform during the teaching process and perception about the educational use of mobile devices. In a next step, children were included in order to explore their senses, emotions, perceptions about the educational use of mobile devices. Subsequently, comments were made during classroom work and the various activities proposed outside the classroom, specifically in recreational spaces. The information obtained was classified into categories according to the expressions of the students.

4. Results

The results obtained in this research are presented in relation to the objective of "Determining the perception of teachers about the educational use of mobile devices".

In the focus group prior to the use of tablets in the study school, teachers mentioned certain fears referring to:

- Fear of possible damage from tablets.
- Replacement of the table in case of damage.
- Poor training in the software of the tablets.
- Commitment to carry out the project at the Institution.

Teachers' expectations can be detected:

- Digital resources are an instrument for improving learning.
- Fears will go away with the practice.
- Extended training to replicate what has been learned.
- Children will get to use tablets better than teachers.
- Parents will accept the use of digital resources in the classroom.
- The software is viable to generate other programs.

In individual interviews, teachers expressed their experiences in using tablets despite the fears expressed prior to the implementation of the use of digital resources. They currently value positively the use of technology in the classroom. They mention that children have greater openness, that education becomes more practical and that by manipulating, seeing, observing they learn and understand much more. They also add that the use of tablets is positive because it is a tool that attracts the attention of children and, because they like it, they concentrate more. In addition, teachers refer to tablets as motivating resources that give children the opportunity to experiment, excel, not limit themselves and go further.

Below are the results that account for the goal of determining the student's perception of the educational use of mobile devices. Likewise, the categorization of students' perceptions will be observed according to the level of basic general education they pursue and, also, the relationship of perception among educational actors.
In the Children's Group of Elementary School, responses about their perception of tablet use were classified into the following categories:

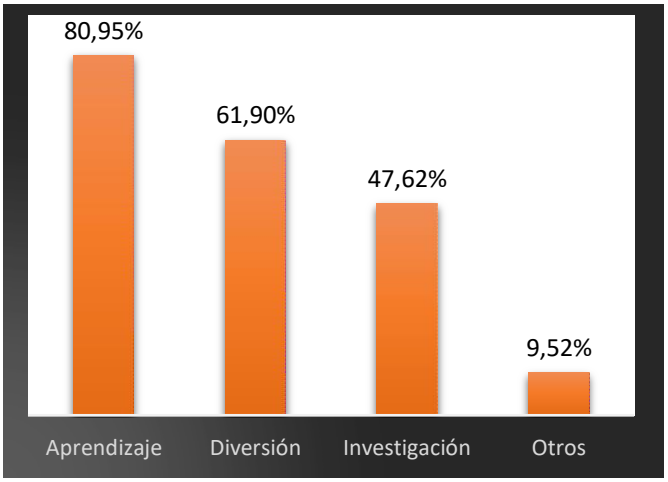

Figure 1. Categories of 4th grade

One noteworthy aspect is the reference made about the tablet being used to investigate. It is a remarkably positive indicator because educational institutions must foster an interest in researching, consulting, discovering and investigating, and this is precisely what children are referring to. It is observed that the teacher applies "the reverse classroom" during the teaching process.

The inverted classroom or flipped classroom is:

> A teaching method whose main objective is for the student to assume a much more active role in their learning process than the one they traditionally occupied. The main idea of this methodology is framed in the possibility for the student to review, study, report theoretical concepts with the support of various resources or tools (Berenguer, 2016).

The research carried out shows that the participating teacher motivates their students to carry out a previous home review of the content that will be addressed in class, the children carry out that review not only by using internet since not everyone has electronic devices in their homes or internet access, children can research through other resources mentioned: physical texts, newspapers or information extracted from their relatives. They come to the school with previous knowledge and also the possibility of having a time to review the contents in the tablets. This procedure helps them achieve meaningful learning as expressed by the teacher.

Significant learning is based on the following idea: "true knowledge can only originate when new content has a meaning in the light of the knowledge already learned" (Ausubel, 2002, p. 122).

The group of children in the Fourth Year of Elementary highlights the methodology of the teacher as motivating and significant in the research. One of the children expressed that working with tablets was the best thing that could have happened to him at school because he learned and had a lot of fun while researching with the tablet.

In the Sixth Grade of Elementary, the answers were classified into the following categories.

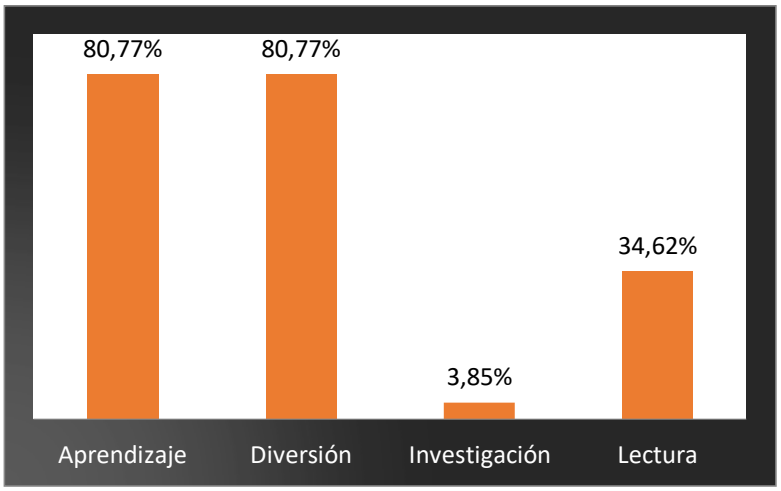

Figure 2. Categories 6th of Elementary

The results of the responses obtained in sixth graders are directly related to the answers issued by the fourth-year-old students in terms of categories. However, the students coursing sixth grade consider that the use of tablets is directly related with learning and fun. These two categories reach exactly the same percentage and a minimum percentage considers the tablet as a resource to investigate. In this group there is another category related to reading.

Another group of children consulted expresses that the tablet is used to read, this relates directly to what is referred by the teacher responsible for this group of children. In the interview the professor mentioned that the tablet is a good resource for children to read, especially stories as they consider the information loaded on the tablets to be very basic and poor. On the other hand, one of the children of this group expressed that using the tablets is "great", it is like using a book, but it is also possible to find stories, word search and many more things".

In the children's group of seventh grade, the responses that show children's perception of the tablet were classified into the following categories:

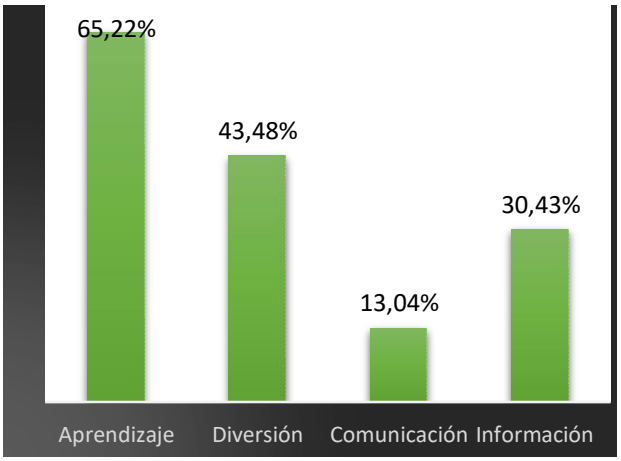

Figure 3. Categories of 7th grade

Two new categories appear in the seventh grade: communication and information. Communication is related to the use of social networks and information with the possibility of using the tablet as a resource to obtain information. These two categories were not

observed in the previous study groups. At this point, it is considered relevant to mention that seventh-year students aging from 11 to 12 benefit when they do things with their peers. At this stage they "develop skills necessary to practice sociability and intimacy, which allows them to have a sense of belonging" (Papalia, 2012, p. 336). This feature of the development stage of this group of children relates to the ideas they mention about the correlation between tablet use and social media. Children in this age "learn roles and rules as well as leadership, cooperation, and communication skills" (Papalia [2012], 336). This last aspect – communication - has a direct involvement with social networks. It should be clarified that in the classroom, teachers do not allow the use of social networks, the resources used are not aligned to this topic; however, the idea provided by children of this age should be considered.

The students in this group confirm what the students of fourth and sixth grade have pointed out, i.e., they perceive the tablet as a resource of learning and having fun.

5. Discussion and conclusions

Significant results were found in this study, since it is observed that 75% of children participating in this research associate the use of the tablet with learning. They mention that the digital resource allows them to access information in areas related to the subjects that are part of the curriculum. They also add that it serves them to "study" by referring to their pre-performance preparation of academic assessments.

Therefore, if tablets allow learning, it would be important to analyze educators' teaching strategies, i.e., consider the possibility that tablets also serve to teach thinking that technological resources are means to obtain the knowledge. However, it must not be forgetten that these are not an end in itself. The methodologies used in the classroom must be aligned to the surrounding world and respond to the interests of the students achieving a motivation to learning.

Several studies have shown that improving the teaching-learning process is directly linked to the motivational factor. Ospina (2006) stated that “one of the most relevant aspects for learning is motivation and there is no doubt that when motivation does not exist, students hardly learn” (p. 158). Students participating in this study showed signs of being motivated against tablet use. Their teachers also report positive aspects in the attitudes of students that would demonstrate a good level of motivation towards the use of the device, this would facilitate learning.

On the other hand, something that can be valuable is the perception that students express when referring to the tablet as an optimal resource to investigate. This is considered highly positive in view of the need for educational institutions to promote an interest in researching, consulting, discovering and investigating, and this is precisely what children are referring to.

Ossa Jorge (2005) in his study “Educate is to teach to investigate, research as a process of formation”, affirms the need to "demystify research with the aim of eradicating the myth that research is unattainable" (p. 526). Human beings can investigate in view that being human means being curious. Being an inquirer is not an elite business, it is natural to the human. Therefore, investigating at an early age allows the early development of scientific acquisition strategies.

If the tablet is seen as a resource for research, fact internalized in students, then teachers and the education system in general already has an excellent tool, a resource that can report quality access to knowledge. In this sense, a strengthening of the use of the resource is required in order to sustain and improve the student's view of this technological resource. Additionally, the fourth-year children participating in this study claim that the tablet allows them to carry out activities related to research. A relevant fact is that this result relates directly to the methodology used by the teacher responsible for the group, since it emphasizes research, awakening interest and curiosity in the inquiry of topics related to the areas of curriculum. The teacher considers that a book is limiting and that the internet and technology allow the students to go beyond what is established in the ordinary curriculum, thus, the professor daily runs the methodology of the reverse classroom to allow a more dynamic learning, and participatory with many possibilities of interaction between students. The use of the tablet for teachers is a key resource that allows the implementation of innovative methodologies in the classroom.

If thinking as Leiva (2008) who claims that teachers believe that the origin of the conflicts that occur in their educative centers is mainly social (51.3%), we can provide more value to the judgment issued by children about the tablet as a vehicle of knowledge to other realities. In the same research, 23% of teachers consider that the origin of conflicts in their schools is emotional. 15.4% of teachers value the origin of conflicts in the cultural dimension, while only 10.3% believe that this origin occurs in the academic field itself. This result is relevant since it confirms a tendency among teachers to conceive that school conflicts increasingly have a social dimension instead of a purely academic (Leiva, 2008, p. 5).

It is therefore concluded that interculturality must be proposed and worked in educational institutions in order to generate attitudes that, based on respect for other cultures, overcome the deficiencies of cultural relativism. Respect and appreciation of other cultures will lead to coexistence, a scant virtue in our society. According to the perception of students and teachers, the use of the tablet would then allow to know other cultures through the search in programs like google. This is possible thanks to the project's tablets with internet access. This activity should be proposed and guided by the teacher in view of the knowledge that the resources previously installed on the tablet do not include any element that facilitates this knowledge.

The proposal to use the tablet in various activities as mentioned above requires the creative and innovative capacity of the teacher. However, it also requires sustained and regular training that also gives teachers the security to solve classroom processes.

It is also important to consider the unwillingness towards the use of an innovative resource. Prior to the start of the implementation of the Digital Classroom Project, teachers expressed fears about some aspects of the lack of training received. In this sense, the also mention the lack of practice with the tablet before its use in the classroom with students.

For some teachers, the tablet could be related to a threat since many consider that children are digital natives versus teachers as digital immigrants. The use of the tablet lowered the levels of fear against the use of a digital resource unknown to many, especially for those teachers who are over 45 years of old and have a long history in the Ecuadorian Education.

Teachers also expressed fear of physical damage to the electronic device and questioned how the return of the electronic device would be made in case of damage caused by the same teacher or by one of the students. It should be emphasized that teachers who work at elementary (second, third and fourth year) show more fear for the damage of the tablets in relation to those teachers at the other levels (fifth, sixth and seventh grades) and mention

that children at an early age do not take care of their objects, and they also indicate that prior to the use of tablets it is advisable to spend time preparing students in the optimal care of the device. These aspects highlight the need to train teachers and think about pre-implementation work of projects with students, it is important to determine needs, make an adequate diagnosis based on this plan and execute projects linked to the community, institutional and personal needs.

Another aspect that children refer to is the possibility of learning mathematical operations, through the use of tablets, a process of great relevance in elementary school. In this study, participants show interest in technological use linked to learning Mathematics.

Other children also refer to a learning of values through the use of tablets, this aspect is related to the National Agreement announced by the Ministry of Education (MINEDUC, Vuelven a las aulas el maestro, los valores y la alegría, 2019) where it is mentioned that values will be recovered through education. For this reason, incorporating resources in tablets that support the work of Education in values aimed at fulfilling the development of citizen capacities would optimize the desired results in this current national agreement. The discourse of the highest authority of the Ministry of Education seems to be internalized by the teachers participating in this study and, therefore by the children who tend to replicate not only the discourse but the attitudes of those who consider their model: the teacher/authority.

Another aspect that the children participating in this study mention is the possibility of reading stories in this digital resource. Reading allows a highly significant contribution to the learning process. This aspect has been considered by the Ministry of Education which states that "the absence of reading activity is one of the great weaknesses in the construction of the sense of citizenship in Ecuador" (MINEDUC, Textos escolares y lectura en el sistema educativo, 2018).

Therefore, the Ministry of Education promotes projects that seek to strengthen motivation and a desire for reading throughout the educational community, not just for students. In fact, a web portal of the same Ministry states that "if teachers do not read, we will hardly be able to have students to do so". Consequently, if the use of the tablet in the classroom allows the approach and possibility to read, this process should be strengthened and aligned with other government projects such as the "National Plan for the Promotion of the Book and Reading of Ecuador, based on a public policy covering the main problems related to reading stimulus in Ecuador" (Ministry [2019], p. 4). This project also determines the need to encourage reading behaviors and reading consumption to promote an equitable and sovereign society, as determined by the Organic Law on Culture in Articles 120 and 126. The fulfilment of this constitutional mandate is the responsibility of the Ministry of Culture and Heritage and the National Government" (Ministerio, 2019, pág. 4).

While it is true that the implementation of this project is the responsibility of the Ministry of Culture and Heritage, efforts must be unified between that Ministry with the Ministry of Education in addition to the private company - as is the case of Fundación Telefónica - in such a way that results, in the field of reading processes, have a significant impact on learning-teaching processes. If children perceive and value the tablet as an optimal resource for reading and discover it as equal to a book, it would be appropriate to propose activities articulated with the use of the tablets at all levels of education, further encouraging reading in teachers.

To conclude the discussion regarding children's appreciation of the tablet as an educational resource, it can be concluded with the idea of the importance of fun learning or, by its counterpart, the fun led to meaningful learning. In fact, any educational process should be perceived by a child as a space of fun that allows learning for life.

In the application of tablets as a resource in the classroom, it has been understood in this study that the guidance, perception, assessment and acceptance of the digital resource by the teacher has a direct and considerable influence on the perception of students.

Therefore, the role of the teacher in the classroom through the use of the tablet will have a significant impact on the perception, use, usefulness and assessment that the students have of the digital resource directed towards a motivation for learning. Therefore, sustained teacher training is required with monitoring and evaluation processes that allow for adjustments in the implementation of the Digital Classroom Project as well as the use of other innovative methodologies in the classroom.

It is clear that the tablet as a digital resource in the classroom has achieved positive results in the learning processes. All participants perceive and value the resource as positive. They assume it as a bridge that brings them closer to the knowledge of other cultures. It gives them the ability to research by generating meaningful learning.

This research gives light into improve student´s academic performance by using a tablet.

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REVISTA CÁTEDRA

Aplicación *Android* para fomentar el aprendizaje del idioma Kichwa

Android application to foster Kichwa language learning

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Resumen

El idioma Kichwa es uno de los pilares fundamentales de pueblos ancestrales en América latina y forma parte de una cultura nacional. Este idioma en el Ecuador está reconocido como lengua oficial por la Constitución y la Ley Orgánica de Educación Intercultural (LOEI). El Kichwa es hablado por varias comunidades del callejón interandino, sin embargo, los conocimientos han sido transmitidos en Castellano. El presente artículo propone el desarrollo de una aplicación con sistema operativo Android para establecer una guía de aprendizaje interactiva del idioma Kichwa en Ecuador. En la actualidad las personas se encuentran muy familiarizadas con el uso de dispositivos móviles sobre todo con teléfonos inteligentes; las aplicaciones son desarrolladas con diferentes propósitos y pueden ser adquiridas por los usuarios dependiendo de sus requerimientos, se han convertido en una herramienta digital sumamente utilizada tanto por estudiantes como por docentes por su accesibilidad y su entorno inteligente. El propósito es encauzar estos lineamientos tecnológicos para priorizar culturas, saberes ancestrales, costumbres y valores comunitarios. El idioma como elemento histórico, social y cultural contribuye a reafirmar la identidad, por ello con base en una investigación documental se determinará información para desarrollar aplicaciones móviles, esto permitirá establecer un diálogo directo entre la tecnología y el entorno sociocultural.

Palabras clave
Android, aplicación, aprendizaje, cultura, Kichwa.

Abstract
Kichwa is one of the main pillars of ancestral people in Latin America and is part of a national culture. This language in Ecuador is recognized as an official language by the Constitution and the Organic Law on Intercultural Education (LOEI). Kichwa is spoken by several communities of the inter-Andean communities; however, the knowledge has been transmitted in Spanish. This article proposes the development of an application with Android operating system to establish an interactive learning guide of the Kichwa language in Ecuador. Today people are very familiar with the use of mobile devices especially with smartphones; applications are developed for different purposes and can be purchased by users depending on their requirements, becoming a highly used digital tool by both students and teachers for their accessibility and intelligent environment. The purpose is to channel these technological guidelines to prioritize cultures, ancestral knowledge, customs and community values. Language as a historical, social and cultural element contributes to the reaffirmation of identity, so on the basis of documentary research information will be determined to develop mobile applications, this will allow a direct dialogue between the technology and the socio-cultural environment.

Keywords
Android, application, learning, culture, Kichwa

1. Introduction
The use of tablets or smartphones has grown hand in hand with mobile applications for Android operating systems; one of the areas where they are applied is in education, as they strengthen teaching-learning processes. Ecuador is an intercultural country, the Organic Law on Intercultural Education (LOEI) published in the year 2011 and the Ministry of Education 2016 establish rules and policies to strengthen respect for indigenous communities, people and nationalities; being one of the relevant aspects of our culture the Kichwa language (p. 29-32). This research paper proposes the development of an interactive Kichwa language learning guide to rescue the culture.

Education is currently a right established in Ecuador's constitution. Having a quality education is one of the greatest challenges facing the Ecuadorian state. In this regard, Article 26 of Ecuador's Constitution states:

> Article 26.- Education is a right of people throughout their lives and an inescapable and inexcusable duty of the State. It is a priority area of public policy and state investment, guarantee of equality and social inclusion and an essential condition for the good living. Individuals, families and society have the right and responsibility to participate in the educational process (Asamblea Constituyente, 2009, p. 27).

To obtain quality in education, exclusion and discrimination must be avoided. Analyzing the educational needs of students and human diversity in their social, ideological, cultural and ethnic aspects will enable the development of educational competences (Ministerio de Educación, 2013, p. 18). The Ecuadorian state has signed several national and international agreements to guarantee the rights of students for a quality education (Ministerio de Educación, 2013, p. 13).

Indigenous people and nationalities use and maintain ancestral languages that are for official use. In this regard, Article 2 states:

> Article 2.- Spanish is the official language of Ecuador; Spanish, kichwa and shuar are official languages of intercultural relationship. Other ancestral languages are of official use to indigenous people in the areas where they live and in the terms established by law. The State shall respect and encourage its conservation and use (Asamblea Constituyente,2009, p. 16).

Ecuador seeks to mitigate the cultural shock and it strengthens the presence of indigenous languages to strengthen the teaching-learning process of two languages (Spanish and Kichwa), meeting the needs of the two languages. Curricular adaptations necessary for the transmission of languages that form the culture since ancient times have been done; therefore, the country has the Bilingual Intercultural Education System (SEIB), contemplated in the Organic Law of Intercultural Education (Ley Orgánica de Educación Intercultural, 2017, 51-57).

In this research perspective the following question arises: Are there Android apps that promote Kichwa language learning? The aim of this study is to determine and apply Android operating system. This type of system has the Linux kernel, which means that the operating system is open, free and cross-platform (Borrego, 2012, p. 2) which allows to take advantage of all the technological features in the development of an interactive guide to learn a language.

Kichwa language is recognized as the official language of the country, and by having a learning guide the students will be familiar with aspects of their culture. The use of technological tools is important in order to create solutions that support the learning of ancestral languages of Ecuador. In Ecuador, the SEIB indicates that education starts from early stimulation to the High level (Ministerio de Educación, 2019).

The research is documentary and will determine information related to the new technological trend of mobile application focused on learning the Kichwa language in Ecuador. With the information collected, it is proposed to develop an application under the same Android operating system, which can be used by both students and teachers.

The article is structured in four parts: The first part shows generalities in the educational context focused on interculturality in education and on the importance of the Kichwa language. The second part is the development of research with related work in the field of applications in the teaching of the Kichwa language. The third part is to develop an Android app to encourage the Kichwa language in the teaching-learning process. Finally, the last paragraph presents the conclusions of the work.

2. Educational field

2.1 Interculturality

There is a wide cultural diversity at the global level; the United Nations for Education, Scientific and Cultural Organization (UNESCO) defines interculturality as "a comprehensive and human rights approach that refers to building equitable relations between people, communities, countries and cultures" (UNESCO, 2006, p. 17).

It is worth mentioning that interculturality not only implies the coexistence of culture, but rather a sustainable relationship of the whole society framed in the respect, maintaining

communication and tolerance that allows to overcome exclusion or any kind of prejudice generated in a culturally diverse society. Mutual learning between different cultures encourages and enriches a country, but above all it promotes intercultural education.

2.2 Intercultural education (Legal foundation)

In the educational field, interculturality presents an equitable dialogue between different cultures in order to strengthen the ancestral knowledge and inclusion. In this context, Ecuador seeks to institutionalize interculturality by implementing laws, policies, programs and projects at the national level (Ministerio de Educación, 2013, p. 18).

After the elaboration and publication of the 2008 Constitution, which contemplates interculturality and multinationality in the idea of Good Living and with regard to Intercultural Education, the following is established:

> Article 343.- The purpose of the national education system will be to develop individual and collective capacities and potentials of the population, which enable learning and the generation and use of knowledge, techniques, arts and culture. The national education system will integrate an intercultural vision with the geographical, cultural and linguistic diversity of the country, and the respect for the rights of communities, people and nationalities (Asamblea Constituyente, 2009, p. 160).

In March 2011, the Organic Law on Intercultural Education (LOEI) was approved. This project advocates interculturality in order to ensure that everyone can access education as shown below.

> Article 1. Field. - This Law guarantees the right to education, determines the general principles and purposes that guide Ecuadorian education in the framework of the Good Living, Interculturality and Multinationality, as well as the relationships between its actors (Ley Orgánica De Educación Intercultural, 2017, pág 8).

2.3 Bilingual intercultural education (Legal foundation)

The Organic Law on Intercultural Education guarantees the right to education and formulates fundamental aspects in the educational field. One of the edges is Intercultural Bilingual education, in which the teaching-learning process of two languages is defined. According to the information found on the website of the Ministry of Education Ecuador has 14 nationalities and 18 towns detailed below:

> Nationalities: Shuar, Awá, Eperara siapidara, Chachi, Tsa'chi, Kichwa, A'i (Cofán), Pai (Secoya), Bai (siona), Waorani, Achuar, Shiwiar, Sapara, y Andoa (Ministerio de Educación, 2019,pág 2).

> Kichwa towns : Otavalo, Palta, Panzaleo, Puruwa, Karanki, Salasaka, Saraguro, Tomabela, Waranka, Chibuleo, Kayambi, Kichwa Amazónico, Kisapincha, Kitu kara, Kañari, Manta, Huancavilca, Natabuela and Pasto (Ministerio de Educación, 2019, p 2).

Each of the nationalities and people has its own education, recognizing the rights established in the Constitution of the Republic of Ecuador. In addition, it recognizes the Afro-Ecuadorian and Monsoon people (Ministerio de Educació, 2019, p. 2)

2.4 Kichwa language

The Kichwa is a family of languages originated in the Andes. It is spoken in countries such as Ecuador, Peru, Bolivia, among others. Throughout history, the Kichwa has been gradually replaced by the Spanish language due to the Spanish conquest. Currently in Ecuador according to Mejeant:

> Kichwa language is spoken in the inter Andean from the north of Imbabura to the south of Loja province and in the Ecuadorian East in the provinces of Napo, Orellana, Pastaza, Morona Santiago and Zamora Chinchipe" (Mejeant, 2001).

The Kichwa language as mentioned is spoken in several provinces at the national level by indigenous communities, the use of the language is part of the culture. Language is part of a country's cultural heritage, as it involves cognitive and intercultural knowledge.

2.5 Android app

Technology has advanced markedly over the years and it has revolutionized the life of the whole world; Information and Communication Technologies (ICT) are present in education, and there is no doubt that new technologies changed the teaching-learning process, in which the role of the teacher and the student has changed. The teacher seeks new strategies where teaching technological resources are used to reach students; the same as using digital platforms and mobile devices have access to educational tools for their training.

The use of ICT in the educational field has evolved over the years, every day there are new digital tools and devices for information, one of them is Mobile Learning term that refers to the use of mobile devices for learning, where people interact anywhere. This new technological trend contributes to education, where students are more productive when using mobile apps, because they feel motivated (Telefónica, 2016, p 4-5).

An Android Operating System is present on mobile devices such as smartphones, watches, cars, tablets and TVs. It is an open source system based on the Linux Kernel (Borrego, 2012, p 2) that allows to control the mobile devices mentioned above. In recent years and due to technological advancement it has been an operating system that has managed to consolidate as one of the most widely used in the world and with greater prospects of development due to the stability it has. In Figure 1 can be observed the growth of the Android operating system from 2009 to 2018.

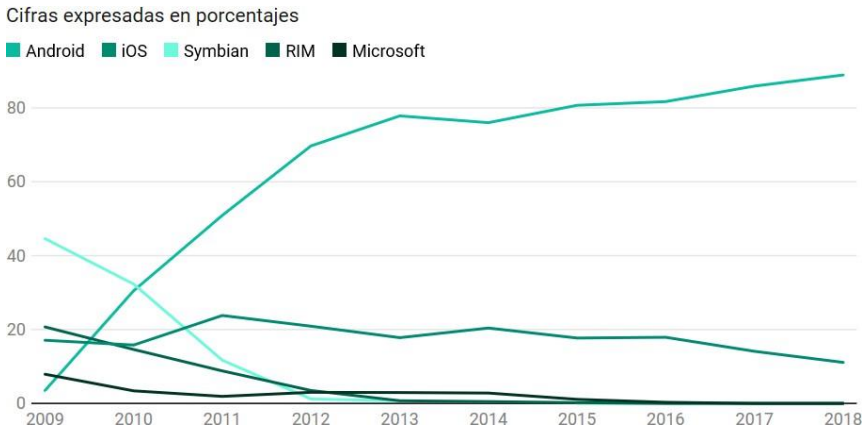

Figure 1. Evolution of Android market share. Accelerated Android growth from 2009 to 2018. Source: (Statista, 2018, p. 1)

The statistics show that the Android Operating System has grown markedly in recent years since 2009. According to RIMy Symbian operating systems, in 2009 it had a higher usage percentage than Android. In other words, at the beginning it doubled and even quadrupled the computers that used these operating systems. But from 2011 and 2012 it totally declined to critical levels where there are little computers that use these operating systems.

With regard to Microsoft's operating system for smartphones, it became a minority system, which did not grow in recent years and has had little impact with regard to Android. Additionally, the IOS operating system is considered stable because it has remained in the years, but attention should be paid to the fact that between 2014 and 2018 it has had a considerable decrease. What is clearly striking is the increase that the Android operating system has had so great, in the figure it is shown that between 2009 and 2010 it doubled to one of its main IOS competencies. This shows that over the years all operating systems on the market have been consolidated and surpassed by reaching figures of 80% of smartphone usage to date.

Additionally, the growth of Android is also attributed to the increase in the number of applications available on Google Play, by being free or by having low costs. Therefore, Android is consolidated as one of the most widely used operating systems in the world for smartphones with more than 2000 devices in the world and more than three million applications (Statista, 2018, p. 1).

3. Related works

This study was documentary type with works related to the development of mobile applications for learning the Kichwa language. Kichwa language is spoken in 13 provinces of the country, but it has variants since it depends on where it is spoken. María del Pilar Cobo states that:

> Our kichwa is a variant of Quechua that is spoken only in our territory. The particularity of the Ecuadorian variant is that it does not have the vowels –e and –or (hence it is called kichwa and not Quechua) (Romero Lucia, Guanolema Cesar, Caiza José, 2016, pág 12).

After gathering information with Applications related to Kichwa in countries such as Colombia, Peru and Bolivia, it is evident that there is a greater influence of Android applications for the Quechua language. Therefore, dialects, grammar, accent and pronunciation varies by country within the region. For example: home in quechua is written *wasi* and in kichwa *kawsay*. This shows the indigenous characteristics of each of the indigenous people of each country. The following shows a collection of Android apps applied to the Quechua language in other countries to have international references as shown in Table 1.

Name	Description
Curso de Quechua	Curso de quechua is basic for beginners or for people who are starting to learn quechua, but it later adds more topics.

Habla Quechua	Aplicación que contiene clases, nombres en quechua, diccionario, historia, videos e información en quechua. App containing classes, Quechua names, dictionary, history, videos and information in quechua.
Diccionario Español y Quechua	App that allows to translate words from the Spanish to Quechua.
LearnQuechua	It contains modules for learning colors, animals, letters and body parts in the quechua.
QichwaDic - Diccionario de quechua	Quechua – Spanish dictionary containing: - Cuzqueño quechua - Ancashino quechua - South unified quechua - Bolivian quechua - Cuzqueño colonial quechua - Apurimeño quechua
Aprendiendo quechua	Quechua language learning app, very easy to use and incorporates nice graphics, pronunciation audio and writing for people to learn how to pronounce variety of words
Curso de quechua	Course to learn quechua
Wawa-Quechua	It allows children from 3 to 5 years old to learn quechua. Among the relevant contents are vowels, consonants, numbers, family, colors, fruits, animals and expressions.
Cuentos en Quechua Perú	The stories are written in Spanish and Central Quechua language but can be understood by the different speakers of the language, since the central variant is like a prototype of the different varieties.
Aprende Quechua	Learn quechua by playing, which includes pronunciation and some phrases, additionally it shows number information, family, colors.
Play Quechua	App displayed as a game where people have to translate to quechua the word that appears.
YachayQuechua	Encourage the use of quechua language through notes, current news, music, videos, comics, games.
LlulluWawa	It makes it easy for children from 3 to 5 to learn quechua through sounds and images of vowels, colors, family.

Quechua Bolivia	A radio in quechua.
English Quechua Dictionary	App that allows to translate words from English to quechua.
Warma	Oriented to the teaching and learning of language and mathematics in Quechua, aimed at children of initial and primary education of communities.
Allin Kawsay	It is an app that helps health professionals in health care and record the clinical history of quechua patients speakers.

Table 1. Quechua language Android apps in Latin America hosted on Google Play where Android-type apps are located worldwide. Adapted from: (Google Play, 2019)

Below is a table with Android apps in Ecuador's Kichwa language. The platform where apps are published is a virtual store where all users who access it can download the apps. It is on the mentioned site where all the information regarding each application that contributes to the Kichwa language was collected. The information is shown in Table 2, with the name and description of the applications.

Android App	**Description**
Diccionario Kichwa Unificado	It is a dictionary that allows to find the translation of words in Spanish to Kichwa and vice versa.
Kichwas	It is a translator of the Kichwa language to Spanish and vice versa, by entering words by means of keyboard and also with the use of the user's voice. In addition, it allows to translate into a third language such as the English language.
Inti	La aplicación es un chat interactivo, en el cual se tiene una conversación para practicar diálogos en diferentes idiomas: entre ellos castellano, inglés y Kichwa. The application is an interactive chat, in which you have a conversation to practice dialogues in different languages: among them Spanish, English and Kichwa.
Cancionero Kichwa Naporuna	It offers religious songs in Kichwa.
Kichwa English Dictionary	It is a dictionary that allows to find the translation of words in english to kichwa and vice versa.
Runashimi UN	It is a practice game under a cultural context, where a journey is undertaken with cultural challenges of indigenous life. The game features challenges and levels gamers until they win the game.

Wawakunapak	It is a free course with different modules to learn the language, it is mainly for children from 8 to 12 years old.
MUNA	It is an audio guide to the National Museum of Ecuador in the following languages: Spanish, Kichwa, English and French.
Kichwa de Salasaka	It shows the New Testament of the Bible in Kichwa.
Quichua de Tena	It is a Kichwa dictionary, additionally, it allows users to contribute with new words to the dictionary.
English Imbabura High Quichua	Dictionary that requires the Internet to search for English terms to Kichwa.

Table 2. Kichwa language Android apps. Adapted from: (Google Play, 2019, p.1)

The use of new technologies that arise from the technological revolution in which we live and in the face of the rise of Android applications that are most used in both tablets and smartphones. From the information obtained on Google Play where all Android type apps are hosted worldwide, it is displayed that all Android apps focused in kichwa in Ecuador are free. Therefore, everyone who has devices with Android operating system installed can access the apps at no cost.

The information shown in Table 2 indicates that there are 11 applications related to the Kichwa language, 5 are focused on the translation of the Kichwa language, 1 is a game in Kichwa, 1 guided to a language learning course, 2 are related to the religious dissemination in Kichwa and finally the last one is powered by the National Museum of Ecuador as an audio guide to the museum. Based on the data obtained, it is verified that Android apps are little exploited fields for learning Kichwa. The number of applications focused on learning are scarce.

4. The implementation of the Android Application to strengthen the kichwa learning

The development of an Android application called Kaway, in Spanish it means culture, is proposed. Through images it promotes basic elements of the Kichwa language such as colors, animals and numbers. In addition, a random trivia is added that interactively evaluates the basic elements learned.

The agile development methodology was used, which is a process that provides a structured and organized design (Matharu, Mishra, Singh, Upadhyay, 2015, pp 3-4). The stages are constituted as follows: start, to establish the vision of the application in a general way; design, design and development activities; construction, software development and finally the transition where the download of the application to customers is established (Otero Escobar, Castillo, & Díaz Camacho, 2016, p. 2).

The application developed works on the Android operating system, the software development environment used was App Inventor. This program was created by Google to create applications with Android operating system, among its main features it is a free and cross-platform software. It uses a system of blocks to create applications, additionally it has an emulator that allows to carry out tests to check the operation of the applications as if were testing them on the smartphones (App Inventor, p. 1).

Technical aspects were taken into account for the development of a mobile application; therefore, it is essential to have a smartphone where the application is downloaded in its entirety (Romero, Guanolema, Caiza, 2013, pág 2-5). The application is structured as follows, see Figure 2.

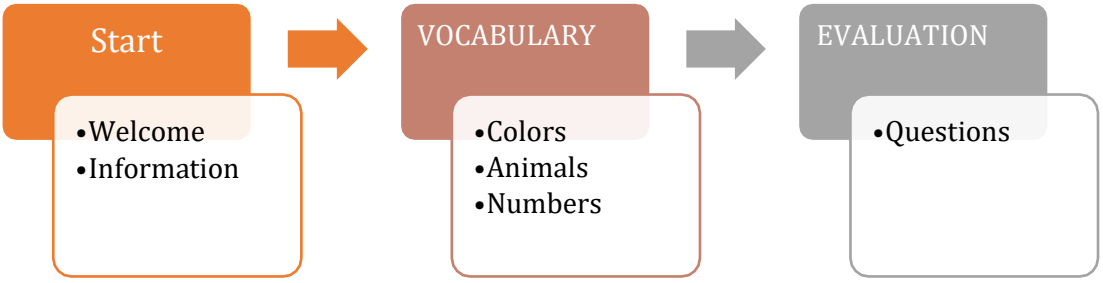

Figure 2. Kaway Android App Module

For users to access the app for free, they can access it through the Google Play store and a virtual store where apps are hosted on *Aptoide*. After downloading the Interculturality app with .apk extension that corresponds to an Android type app. Then it is proceeded with the direct installation that is performed in a few steps as shown in Figure 3.

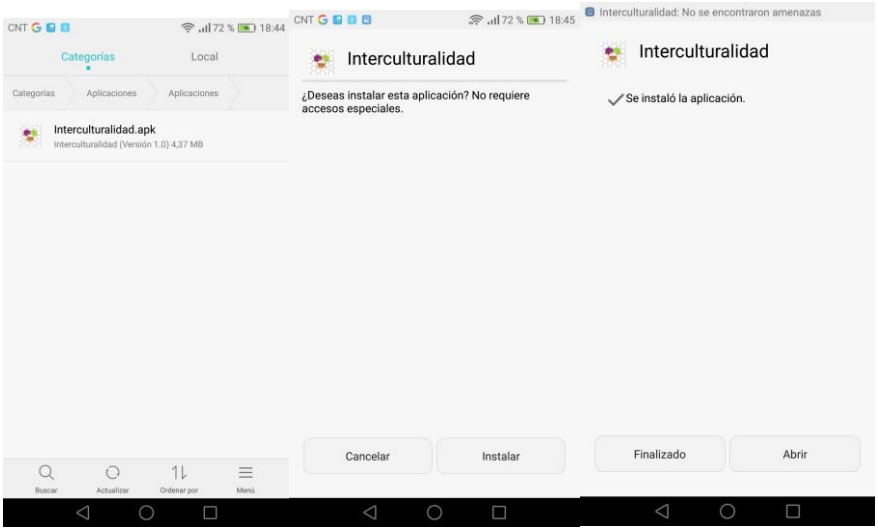

Figure 1. App installation

Operational tests were performed on each of the modules developed in Figure 4, where the welcome screen and the main menu accessed by users and the app information are displayed.

Figure 2. Welcome, main menu and information

In the next module the application has a basic vocabulary with numbers and animals to promote the Kichwa language interactively, the user visualizes images with their meaning in a fun way. The vocabulary module is displayed in Figure 5.

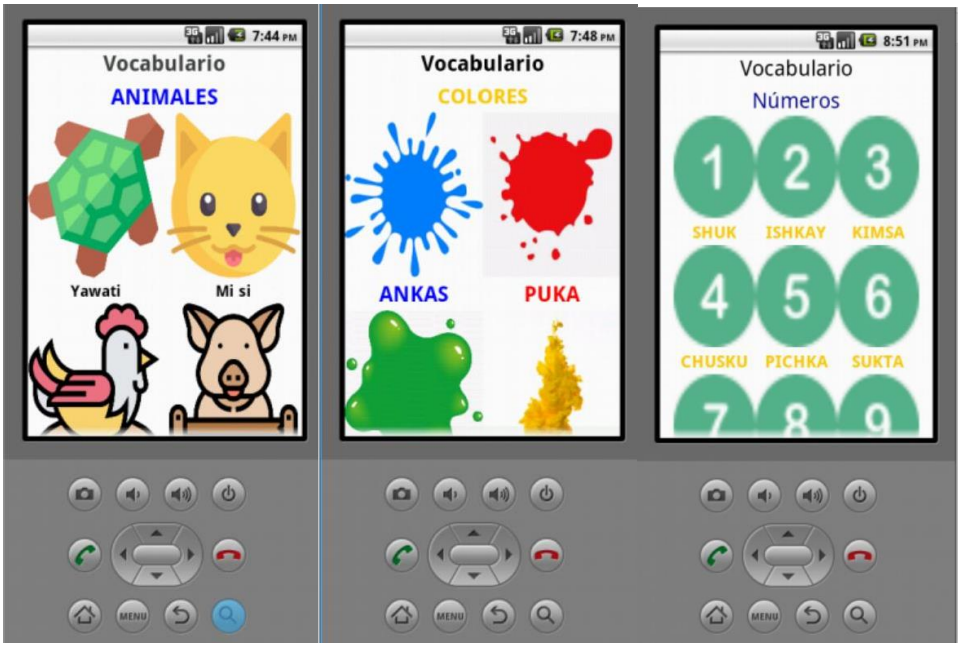

Figure 3. Vocabulary

Questions are asked on the interface shown in Figure 6 from what the student has practiced in the vocabulary module, the questions are presented with random answers to verify what

the student has learned. Each time the question is answered correctly, the score is increased.

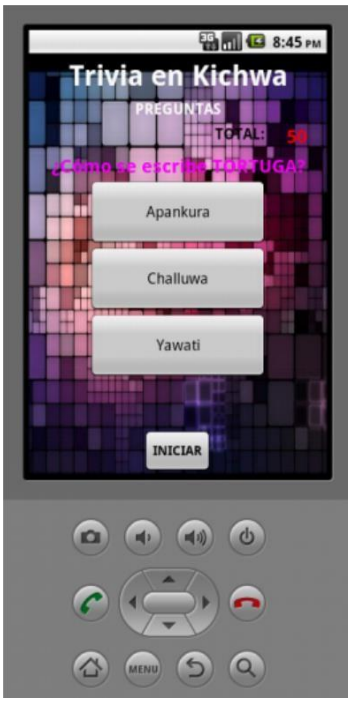

Figure 6. Kichwa Trivia

The application developed for the Android operating system is designed to be used as a mobile learning tool in the educational field. It allows to know basic elements of the Kichwa language through multimedia content to maintain the interest of users who interact with the application. The graphic environment is friendly to generate positive attention alongside a trivia which increases interest in learning and influences the motivation of students.

In addition, new technologies applied to education promote learning inside and outside the classroom; breaking the barrier of time and space where users can access the app no matter where and when they are, since the only device that is required is to have a smartphone.

5. Conclusions

The results and analysis of data presented in the implementation of applications with Android operating system takes an innovative role that quickly adapts in education, especially with technological tools like mobile learning that work on smartphones. This study determined that there are a minimum number of Android apps focused on the dissemination of the Kichwa Language in Ecuador, so it is necessary to contribute with more applications to promote the use of the language, avoiding the loss of our ancestral knowledge that is part of our culture.

The research focused its attention on Android applications due to the boom and noticeable increase of technological advancement in recent years. Mobile applications play a key role in the educational field in contributing to the teaching-learning process with quality. It is

still an extensive field for its exploitation, where the acceptance of users is evident by their friendly interfaces and their free access to most of them.

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REVISTA CÁTEDRA

Aprendizaje significativo de la luminancia porel método punto por punto

Significant learning of luminance by the point-by-point method

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Resumen

Este artículo describe el proceso experimental realizado en la obtención de la luminancia de dos tipos de focos, el de incandescencia y el fluorescente en un mismo ambiente físico. Para realizar el mencionado estudio se eligió el método punto a punto, el cual permite conocer la luminancia en puntos concretos de una superficie bajo una fuente de luz que se ubica a una determinada altura. Además, se trata de conocer el grado de confort visual del sentido de la vista en un lugar de iluminación uniforme. Los resultados obtenidos permiten

realizar diversas comparaciones en el uso de una determinada lámpara, tomando en cuenta la que más beneficios presenta en función de ofrecer un nivel de luminancia y un confort visual apropiado, un ahorro económico y de fácil obtención y reemplazo.

La experiencia en el aprendizaje de Luz e Iluminación en busca de un aprendizaje significativo evoca conocimientos previos tales como: flujo, intensidad, ángulo sólido y luminancia con el objetivo de entender el fenómeno, presentar una nueva información y hacer un f*eedback* en busca de una nueva información que acreciente su pensamiento en la vida cotidiana. Con los resultados obtenidos en la presente investigación se desea contribuya al mantenimiento de las luminarias de las aulas de la Carrera de Pedagogía de las Ciencias Experimentales Matemática y Física de la Universidad Central del Ecuador, las mismas que tienen características físicas similares al lugar en el cual se realizó la experiencia.

Palabras clave
Ángulo sólido, aprendizaje significativo, flujo, iluminación, luminancia, luz, medición.

Abstract
This article describes the experimental process performed in obtaining the luminance of two types of light bulbs, the incandescent and the fluorescent, in the same physical environment. To perform the mentioned study, the point-to-point method is chosen, which allows knowing the luminance at specific points of a surface under a light source located at a certain height; in addition, it is about knowing the degree of visual comfort of the sense of sight in a place of uniform illumination. The results obtained allow comparisons to be made in the use of a specific lamp, taking into account the one that presents the most benefits based on offering a level of luminance and appropriate visual comfort, economic savings and easy obtaining and replacement.

The experience analyzed allowed the application of the basic principles of light and lighting, subjects studied in the classroom, achieving a significant learning about: flow, intensity, solid angle and luminance, without neglecting the search for a pleasant atmosphere of a room through the qualitative and quantitative analysis of the phenomenon. In addition, it is expected that the results obtained in this research serve as a reference to initiate an improvement plan that contributes to the maintenance of the luminaries of the classrooms of the Pedagogy career of the Mathematical and Physical Experimental Sciences of the Central University of Ecuador, which have similar physical characteristics to the place where the research was carried out.

Keywords
Solid angle, meaningful learning, flow, lighting, luminance, light, measurement.

1. Introduction
The role of the education according to the Organic Law of Higher Education (LOES) (Art 13. Literal b) is to "promote the creation, development, transmission and dissemination of science, technology, technology and culture" (p. 11). This role inspired this article whose main objective is to foster an experimental study to compare the luminance between lamps of different species, located in the same physical environment. In addition, it aims to observe

the development and obtain a meaningful learning of the principles of light and illuminance with its different themes.

It considers the comparison between the luminance results of a lamp of incandescent light and another of phosphorescent light, a situation that will allow an appropriate decision to be made in the selection of lamps for a daily use, especially in classrooms in which the learning process takes place. In this regard, Ausubel (1963) states that:

> Significant learning occurs when the contents are non-arbitrary and substantially related (not by-heart) to what the student already knows. Substantial and non-arbitrary relationships are understood as ideas related to some specifically relevant existing aspect of the student's cognitive structure, such as an image, an already significant symbol, a concept, or a proposition (p. 18).

To achieve meaningful learning, active methodologies such as experimentation should be used, resulting in students applying the knowledge to the achievement of a new one. Similarly, Ausubel (1976) and Moreira (1997) explain:

> Meaningful learning is the process by which new knowledge or information relates to the cognitive structure from which it is learned in a non-arbitrary and substantive or non-literal way. This interaction with the cognitive structure does not occur by considering it as a whole, but with relevant aspects present in it, which are called anchoring ideas (p. 2).

Anchoring ideas adapted to the study of artificial lighting in classrooms are a challenge to know whether the physical space in which classes are developed is pleasant and comfortable to the human eye, since performing all activities require stable lighting; this raises the good use of existing artificial lighting. Observational and luminance measurement of a LED or incandescent and fluorescent bulb helps to understand and obtain meaningful learning.

According to Borja Reyes (2017) "Good lighting is adaptable to the place to be illuminated creating a welcoming environment with stable visual comfort" (p. 64). The permanence of humans in a room depends a lot on the lighting of the spaces that are intended for leisure, rest or work. The light visible to the human eye is a small region of the electromagnetic spectrum between 380 nm and 780 nm wavelength, from ultraviolet to infrared, respectively. Studying the nature of white light shows that the set of wavelengths of the visible spectrum when traversing a crystalline prism propagates a range of colors ranging from infrared to ultraviolet, verifying that the wavelength in the infrared is higher than the ultraviolet.

A pleasant environment produces comfort to the sense of sight, in the visible spectrum it is known that the yellow-green light of wavelength 555 nm is the ideal light but accompanied by adequate lighting any activity can be developed with success. For example, churches, theaters, parks, streets, hospitals, classrooms, museums, among others.

The illumination of perpendicular surfaces requires certain levels of luminous flux, being more intense the illumination at the central point. If analyzing a point away from the central position the illumination decreases, being strictly related to the luminous intensity and

height, since the Illumination is directly proportional to the luminous intensity and inversely proportional to the height squared.

2. Materials and methods

The research method used corresponds to quantitative work, verifying the capacity of two bulbs for domestic use in order to achieve significant learning of luminance by the "point-by-point" method. For this purpose, experimentation has been used in the laboratory of the Physics Unit of the Central University of Ecuador. In addition, bibliographic information has been collected from Physics texts, simulators and technological resources from the Web. All the resources mentioned have been identified sequentially in order to make a qualitative and quantitative description experience of the application of light and lighting through a complete experimental descriptive study of luminous phenomena in the study of the wave movement.

3. Related concepts

3.1 Rays of light and shadow

The first properties of light studied in the Wave Movement is the rectilinear propagation of light and shadows that are understood through the visual sense that places distances, directions and forms. For example, the solar clock entering the university theater of the Central University of Ecuador produces the formation of a sharp shadow of an iron pointer that takes advantage of sunlight to measure time.

Considering Huygens principle, each point on a moving wave front can be considered as a source of secondary waves. The wave front at any moment is the covering of these waves. Thus, according to Young (2009) light emitted in all directions through the point source of light can be represented by a series of spherical wave fronts that move away from the source at the speed of light" (p. 1144).

For these purposes, a point source of light is one whose dimensions are small compared to the distances studied. Notice that spherical wave fronts become virtually flat wave sources in any specific direction at distances far from the source. An imaginary straight line drawn perpendicular to the wave fronts in the direction of the moving wave fronts is called lightning. Of course, there are an infinite number of rays that start from the point source.

3.2 Light

According to León (2002) "Light is a manifestation of energy in the form of electromagnetic radiation capable of affecting the visual organ, is called radiation to the transmission of energy through space" (p. 3), that is, light is light is it consists of energized particles called photons, whose energy and frequency determines wavelength and color.

Light is defined as electromagnetic radiation that has isotropic behavior in all directions without the need for a means of propagation. The speed of light propagation is set to a value of 299 792 458 m/s, although it usually approximates 3 x 10^8 m/s. The speed of light is in perfect harmony at frequency and wavelength, with the units being the frequency Hertz (Hz) and wavelength in nanometers (nm). Visible light is able to stimulate the human eye through a luminous spectrum, ranging from ultraviolet to infrared with values between 380 to 780 nm, respectively.

3.3 Luminous flux

According to Domínguez -Martínez (2008) luminous flux "is the luminous radiation capacity valued by the human eye" (p. 30). The luminous flux analyzed as the total radiant power emitted by a light source is capable of affecting the sense of sight. Light sources emit electromagnetic energy distributed over multiple wavelengths. The electrical energy supplied to a lamp emits radiation. This radiant energy emitted by the lamp per unit of time is called radiant power or radiant flow. Only a small portion of this radiant power is found in the visible region: the region is between 380 and 780 nm and is called luminous flux. The sense of sight depends only on visible or luminous radiated energy per unit of time.

The human eye is not equally sensitive to all colors. In other words, equal radiant powers of different wavelengths do not produce the same brilliance. A 40W green light lamp looks brighter than a 40W blue light lamp. Figure 1 indicates the eye's response to various wavelengths. The sensitivity curve is bell-shaped centered approximately in the middle region of the visible spectrum. Under normal conditions, the eye is more sensitive to the green-yellow light wavelength of 555 nm. Sensitivity drops rapidly for longer and shorter wavelengths.

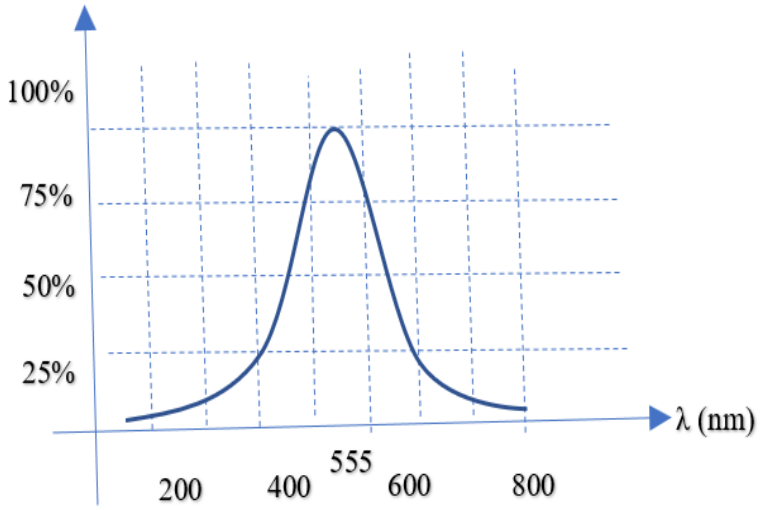

Figure 1. Sensitivity of light to the human eye

Luminous flux is the amount of energy in luminous form emitted by a source. Its unit is the lumen (Lm).

The concept of a solid angle must first be developed to refer to a lumen in terms of the pattern font. A solid angle in stereoradians (sr) is defined in the same way that a flat angle is defined in radians.

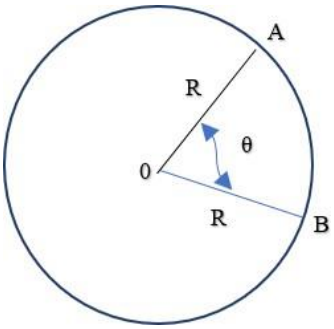

Figure 2. The radian

According to Figure 2, when the arc length AB is equal to the radius R a radian is obtained. The same occurs with the solid angle. This can be thought of as the opening at the end of a cone subtended by an area segment over the spherical surface.

A stereoradians (sr) is the solid angle subtended in the center of a sphere by an area on its surface that is equal to the square of its R radius. In general, the solid angle in steroradians is given by:

$$\Omega = \frac{A}{R^2} \text{ [sr]}$$

Equation 1

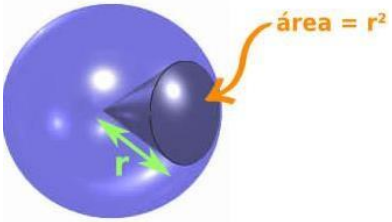

Figure 3. Stereoradians. Adapted from (Disfruta de las matemáticas, 2011)

As well as in the flat angle θ for obtaining the radian, the following consideration is made for obtaining the solid angle of a sphere:

$$\Omega = \frac{4\pi R^2}{R^2}$$

Equation 2

It is considered that: $\Omega = 4\pi$ sr, which is independent of the radius, when defining a lumen from the point of view of power it states that "a lumen (Lm) is the visible luminous flux or radiant power emitted from an aperture of 1/60 section of cm^2 from a light-emitting source, spatially forming a solid angle of 1 sr" (Tippens, 2007, p. 652).

A fluorescent lamp can emit about 4 000 Lm while the light entering through the window can range from 2 000 to 20 000 Lm. This magnitude is typical of each bulb and is a data provided by manufacturers. The light emission of the high solids at high temperatures establishes a standard source at the solidification temperature of the platinum of approximately 1773 °C. In everyday life incandescent lamps are used, which have been calibrated by comparison with the established pattern to understand the phenomenon.

The definition of the luminous flux unit states that "a lumen is equivalent to 1/680 W of 555 nm wavelength of green-yellow light" (Tippens, 2007, p. 652).

5.1 3.4 Luminous intensity

"Is the luminous flux per unit of solid angle in a particular direction. Its symbol is I and the unit in the international system is the candela (Cd)" ((INSHT) & Alvarez Bayonne [2015], 6). The luminous intensity (I) of a light source is the luminous flux (F) emitted per unit of solid angle (Ω) is:

$$I = \frac{F}{\Omega}$$

Equation 3

The essential magnitude of the luminous intensity of the International System (SI) is the candela "cd".

$$1\,[cd] = \frac{1\,[lm]}{1\,[sr]}$$

Equation 4

Because of the latter, the luminous flux is:

$$\mathrm{F} = \mathrm{I} \cdot \Omega$$

Equation 5

and the total flow of an isotropic source is:

$$\mathrm{F} = \mathrm{I} \cdot 4\pi$$

Equation 6

3.5 Lighting or luminance

Lighting or luminance ($\vec{E}$) of a surface (A) is defined as the luminous flux (F) per unit area:

$$\vec{E} = \frac{\vec{E})}{\mathrm{A}}$$

Equation 7

Replacing the luminous flux and solid angle in the previous expression:

$$\vec{E} = \frac{I \cdot \Omega}{A}$$
$$\vec{E} = \frac{I \cdot \frac{A}{R^2}}{A}$$
$$\vec{E} = \frac{I}{R^2}$$

Equation 8

The lighting unit E in its units is the Lux.

$$1\,[lux] = \frac{1\,[cd]}{1\,[m^2]}$$

Equation 9

"Luminance" The inverse law of the square states that the lighting level is proportional to the luminous intensity and inversely proportional to the square of the distance. This occurs in a certain direction in which it emits a light source (Álvarez, 2015, p. 12). When interpreting this definition, it is inferred that the light-emitting source produces illumination that decreases as it departs, but the luminous intensity (I) remains constant. For example, if we have a luminous intensity of 36 cd for surfaces located 1, 2 and 3 meters away, the lighting would be 36 Lux, 9 Lux and 4 Lux, respectively. This is because the illumination is inversely squared from the distance to the surfaces on which the light affects.

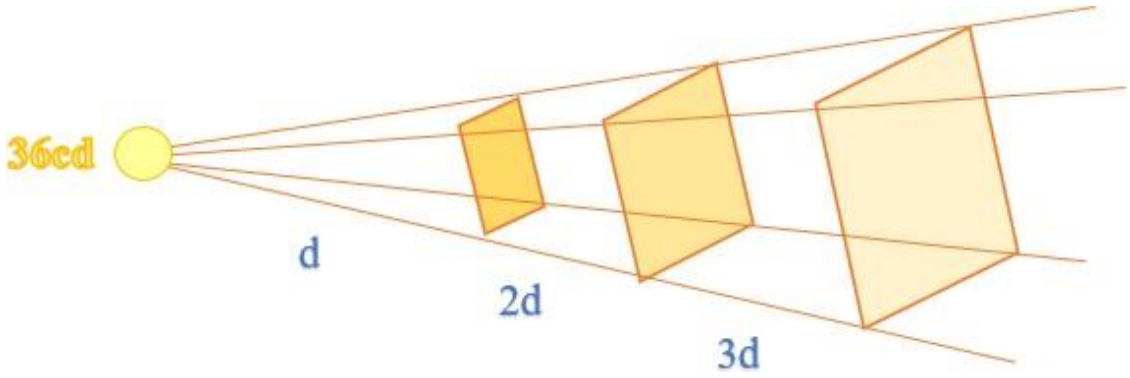

Figure 4. Surface location

The lighting of a surface as it moves away from its incidence area decreases considerably. The point-by-point method determines the lighting or luminance from the normal line to the surface by varying the spacing angles.

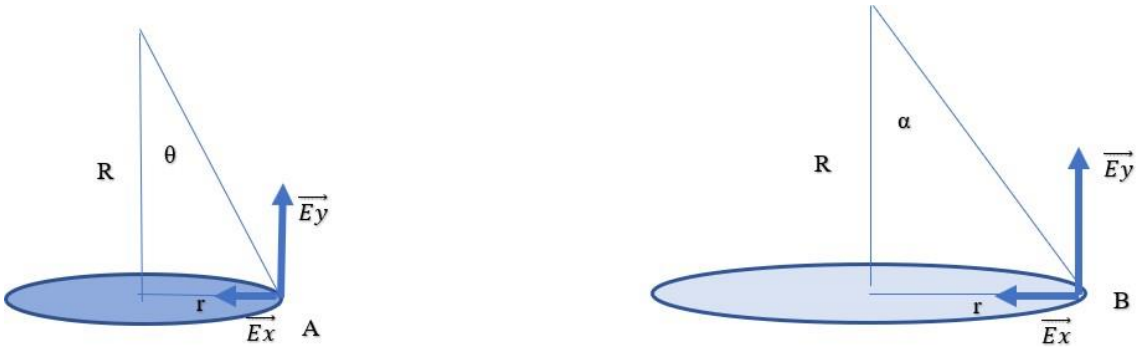

Figure 5. Luminosity of surfaces at different points

Being $\vec{Ex}$ and $\vec{Ey}$ the horizontal and vertical components, respectively, at a point A and B. The angle relative to the normal to the surface varies as it moves away at positions A and B, respectively, then it is met that: $\theta > \alpha$.

4. Point-by-point method

To achieve a cognitive change in the study of luminance, the point-by-point method is used to analyze a point anywhere in the light incidence area. For it, an evocation of what is known and is not known is made about the favorable and unfavorable characteristics of two different bulbs. For the learning obtained to be long-term, it is based on experimentation at the Physics Center of the Central University of Ecuador. Previous knowledge of the subject was used in addition to the data for the understanding of lighting produced by a light bulb. First, the height of the ceiling at which the light is suspended approximately at 3 m, then the observation of a 100 W incandescent bulb (watts) and a fluorescent bulb of 40 W (watts) were considered, being the intensity 130 cd and 200 cd, respectively.

The educational centers have specific lighting requirements, among other things because of the type of activities carried out. Poor lighting of teaching center's facilities, especially classrooms and spaces for classes, learning and study, can lead to visual fatigue, eye damage and could even cause an increase in the rate of school failure because of low student performance

Lightning Table by lux in a teaching center

Area	Luminance
Laboratory	250 to 1000 lux
General Lightning in the classrooms	350 to 1000 lux
Boards	300 to 700 lux
Conference romos	200 and 1000 lux
Library	300 and 750 lux

Cuadro 1. Niveles recomendados de iluminación por zonas. Adaptado de (Helios Strategia Ecuador)

Because of the latter it is inferred that the optimal would be approximately 400 Lux.

4.1 First step

When the angle of the luminous ray with the vertical is not known, then it is calculated as follows:

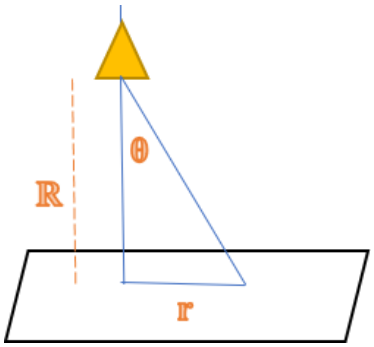

Figure 6. Angle relative to vertical

$$\tan \theta = \frac{r}{R}$$

Equation 10

4.2 Second step

This step determines the I (luminous flux intensity according to the direction of the point to the source). To do this, both the type of lamp and the type of lighting must be chosen. Once this data is available, the photometric curve or light distribution curve is consulted with the lighting manufacturer. Generally, this information can be consulted in any online catalogue of manufacturers of technical luminaires.

Type of lamp	Power	Liht intensity	Graph identification
Incadescent lamp	100 W	130 cd	
Fluorescent lamp	40 W	200 cd	

Table 2. Lighting. Comparative table. Adapted from (Tables and Comparisons, s.f.)

A lighting containing a 100 W lamp is chosen, its luminous efficiency is 58 lm/W with a luminous intensity of 130 cd. A 40 W fluorescent bulb and a luminous intensity of 200 cd are also chosen; therefore, the two compact lamps that in total provide a luminous flux for the two bulbs.

$$F = 100\ W\ x\ \frac{58\ lm}{W} = 5800\ lm$$

Equation 11

$$F = 40\ W\ x\ \frac{58\ lm}{W} = 2320\ lm$$

Equation 12

The latter shows that the luminous flux is higher in the incandescent light. It should be noted that the luminous intensity is set by means of a standard unit, as mentioned in the luminous pattern produced by the platinum metal at 1 773 °C. Based on this data, it is verified that the manufacturers of electric bulbs indicate the luminous intensity in "cd". In the case of dispensing with this data, it is proceeded to check whether the manufacturer indicates the luminous flux in lumen "lm" and the solid angle has to be set in "sr" steroradian.

4.3 Third step

The point-by-point method measures an angle to the normal surface and calculates horizontal and vertical illumination with the following expressions:

$$Ex = \frac{I\cos^3\emptyset}{R^2}\ [Lux]\ ;\qquad Ey = \frac{I\cos^2\emptyset\ sen\ \emptyset}{R^2}\ [Lux]$$

Equation 13

But the resulting at point A point B is the result of the components $\vec{Ex}$ and $\vec{Ey}$ and it is obtained by applying the Pythagorean theorem:

$$E = \sqrt{Ex^2 + Ey^2}$$

Equation 14

4.4 Fourth step (results obtained)

The equations were applied prior to the experience of measuring the illuminance of an incandescent bulb and fluorescent bulb. The measurement of a 100-watt incandescent lamp is 130 cd and of the fluorescent 40 watts is 200 cd. The student states that in a classroom the ceiling is 3 m, his intention is to know the luminosity on a surface, therefore, the student sets the following measurement parameters at different separation angles from the normal line to the surface:

INCADESCENT LIGHT 130 cd			
Θ (degrees)	**Ex (Lux)**	**Ey (Lux)**	**E total (Lux)**
0º	14.40	0	14.4
30º	9.38	5.41	10.82
45º	5.10	5.10	7.21
60º	1.80	3.12	3.60
75º	0.25	0.93	0.96
90º	0	0	0
FLUORESCENT LIGHT 200 cd			
Θ (degress)	**Ex (Lux)**	**Ey (Lux)**	**E total (Lux)**

0º	22.22	0	22.22
30º	14.43	8.33	16.66
45º	7.85	7.85	
60º	2.77	4.81	5.55
75º	0.38	1.43	2.18
90º	0	0	0

Table 3. Data calculation

The "Isolux" diagram indicates the light incidence on a surface from the luminosity of the center towards the outside of the circle that illuminates the lamp:

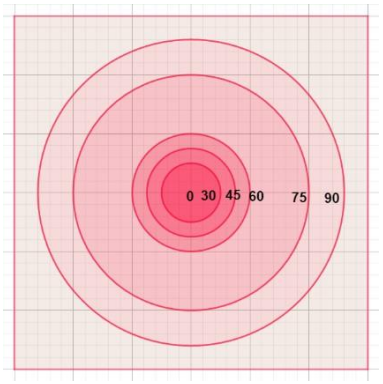

Figure 7. Isolux diagram of surface illumination

5. Conclusions

Applying the point-by-point method can be established the data that allows to assert that the maximum illumination (luminance) is obtained when a light source affects perpendicular to a surface; in the same way, when separated from the vertical it loses intensity. Luminous Flux is lower in the fluorescent bulb, while in the incandescent bulb is higher, unlike the luminance that is higher for the fluorescent bulb. This indicates that the luminous flux is inversely proportional to the comparative luminance of the two bulbs.

The fluorescent bulb produces more luminance at the points studied; therefore, it is much more efficient in addition to being much more cheap because of its low consumption of approximately 1/6 of the consumption in watts of the incandescent bulb. Calculations may vary by different factors, as there are places where the height of the room that was taken as a sample in certain parts is approximately 2.94 m and others of 2.98 m, but for calculation terms the measure indicated by the helpers established by Physics Center at Central University of Ecuador.

En el punto de ángulo 0° respecto a la vertical se produce la mayor iluminación horizontal de 14.4 Lux a 3 metros de altura, mientras que la bombilla fluorescente a la misma altura de tres metros y 0º presenta una **luminancia** de 22,22 Lux. Por lo que la eficiencia en luminancia en los dos casos estudiados en el laboratorio se debe colocar al menos 18 bombillas fluorescentes o 28 bombillas incandescentes.:

At the angle point 0° with respect to the vertical, the largest horizontal illumination of 14.4 Lux is produced at 3 meters high, while the fluorescent bulb at the same height of three

meters and 0° has a luminance of 22.22 Lux. Therefore, the luminance efficiency in the two cases studied in the laboratory should be placed at least 18 fluorescent bulbs or 28 incandescent bulbs:

18 fluorescent bulbs x 22.22 Lux = 399.96 Lux.

28 incandescent bulbs x 14.44 Lux = 403.2 Lux

This demonstrates the greater efficiency of fluorescent bulbs, as they guarantee savings of electricity consumption, higher luminous intensity and the use of 10 bulbs less. In addition, the manufacturer guarantees longer number of duration, so it is highly recommended.

Fluorescent bulbs are white light or warm light, and the human eye is more sensitive to 555 nm of yellow light. This indicates that it is more advisable to use warm light bulbs, but it will depend on the person who performs the activities in that study area.

When applying the point-by-point method, it is concluded that its use is limited to knowing the illuminance at specific points based on previous studies performed in class and by experience in the handling of home bulbs. After being an active subject in experimentation and measurement, it acquires new information observing that a surface is made up of thousands of points so the responses are varied to different locations, even more if different types of bulbs are used. Significant learning in the study of light and enlightenment occurs when theory is closely linked to practice, obtaining new information and the ability to evoke knowledge and achieve successive feedback.

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REVISTA CÁTEDRA

Innovación educativa y su incidencia en el profesorado

Educational innovation and its impact on teachers

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Resumen

El presente artículo tiene como objetivo el análisis de los procesos de cambio e innovación en la educación y su incidencia en el profesorado. El tema adquiere particular relevancia debido a que la educación superior en Ecuador está pasando por importantes procesos de transformación que ameritan revisar los contenidos curriculares y la metodología de enseñanza, aspectos fundamentales que subyacen en todo proceso de innovación o cambio educativo y la adaptación del profesorado a estos cambios. La metodología del presente trabajo consistió en el análisis de los principales postulados de Fullan (2002-2012), Havelock y Huberman (1980), Rutherford y Hall (1990), Rogers (2003), Marcelo (1995-2010), entre otros, que se han dedicado al estudio de los procesos de cambio en el contexto educativo y su impacto en el profesorado. Como resultado de este estudio se identifica como factor fundamental la participación proactiva de los docentes en la construcción y fortalecimiento de los procesos de innovación para la formación integral de los ciudadanos en un marco de compromiso social y ético con la educación en todos sus niveles. El trabajo concluye con un cuerpo de recomendaciones que supone, entre otras, la necesidad de involucrar al profesorado desde el inicio en los procesos de transformación educativa a través de programas de sensibilización, formación y acompañamiento.

Palabras clave
Cambio educativo, innovación educativa, profesorado, educación superior

Abstract
The purpose of this article is to analyze the processes of change and innovation in education and its impact on professors. The topic is relevant since higher education in Ecuador is going through an important transformation process that requires reviewing the curriculum content and the teaching methodology, key aspects that underlie any process of innovation or educational change and the adaptation of professors to these processes. The methodology consisted in the analysis of the main postulates of Fullan (2002-2012), Havelock and Huberman (1980), Rutherford and Hall (1990), Rogers (2003), Marcelo (1995-2010), among others, devoted to the impact of the processes of change in professors. As a result of this study, the proactive participation of teachers in the construction and strengthening of innovation processes is identified for the integral formation of citizens with a social and ethical commitment to the education at all levels. The work concludes with recommendations that implies the need to involve teachers from the beginning in the processes of educational transformation through awareness-raising, training and accompaniment programs.

Keywords
Educational change, educational innovation, professors, higher education

1. Introduction
Higher education in Latin America and the world is conditioned by the acceleration and systematic transformation that society goes through, and by the demands posed by the so-called knowledge society. In this sense, higher education at the beginning of the new century is in crisis worldwide, despite having shown various types of development in the last decades of the twentieth century, forcing to be permanently redefined to face the new challenges. The population, the demand for new skills, the evolution of technology and the accelerated and continuous creation of knowledge, demand constant changes in the educational system.

Referring to changes in education is to recognize the current demands that must be met by society as a whole, because the possibility of innovation processes that are expected to contribute to raising the educational quality depends on this. In this sense, in a context of permanent transformation characterized by globalization, massification, technology and multi-literacy among other trends; openness and adaptation to the process of permanent change must be part of the dynamics of all institutions. This involves developing strategies that respond to these trends by making the curriculum more flexible.

The gaps between social demands and the response of educational institutions have been the subject of multiple meetings, conventions, congresses at the global and local levels, in order to deepen the analysis of new realities and establish agreements and reforms, which allow to outline proposals, projects, strategies, whose main objective is to raise the quality of education.

Evaluation processes have been developed in Ecuador, the results of which have shown serious questions about the relevance and quality of higher education. In this regard, part of the balance is shown by the following:

> It is worth highlighting as the main problems of higher education the questionable management in terms of: quality and relevance, the non-application of the principle of equal opportunities and integrality of the education system, the quality of online education, university autonomy with social responsibility, academic integrality, training and research (Larrea and Granados, 2016, p. 155-235).

There is no doubt that Ecuadorian society is demanding changes in higher education; it has been a necessity to comply with the most substantial part of the Bologna Declaration for Higher Education (1999), in order to be in agreement with the challenges posed by the knowledge society. There are aspects in the Declaration that refer to quality, mobility, diversity and competitiveness to ensure that the educational offer is adapted to social demands. These demands involve changes that require to be debated and analyzed in spaces with the social actors, with the members of the academy, with the university community. This contributes to establishing processes for the development of new educational, pedagogical models and to build the new curricular designs of careers that meet the objective of training future professionals according to the new scenarios related to the country's models of society and the development projects.

> The changes that are taking place in our society affect education and the teaching work. A knowledge society requires innovation and quality-oriented schools. But innovation is not a mandate, it cannot be ordered (Marcelo, Mayor and Gallego, 2010, p. 112).

In any process of change, the active participation of those who will be affected by such change should be considered. In this sense, if a transformation process takes place, its success would depend on the actors of the process with its conception and implementation. According to Fullan (2002a), "to achieve certain kinds of purposes, in this case the educational objectives, these cannot be imposed by a mandate, because what really matters for the complex goals of change are skills, creative thinking and action" (p. 36). In this sense, any process of change and innovation especially in education must arise from a context in which problems are identified and ideas, proposals, projects, reforms, mandates, models are established with the educational actors. Proposals imposed do not have the desired effect.

In this sense, the aim of this research is to analyze the theoretical principles underlying the processes of change and innovation in education, specially of Ecuador (Breilth, 2017) and at Universidad Central del Ecuador (Páez, 2018) which are subjected to a number of factors such as the teacher training, the understanding of the new curriculum model, the ability to assume and make the changes that involve reforms, and above all, the levels of affectation that teachers have on their performance, among others. In short, if there is no knowledge, clarity and training related to the processes to be undertaken, difficulties will arise in their implementation. It is about channeling the sociological, psychological, pedagogical guidelines of change and educational innovation to prioritize inclusive processes and/or create new ones that strengthen those developed by each society, considering the teacher as an actor, facilitator of knowledge with critical and constructivist guidelines, relating them to the family context and the sociocultural environment.

This work is divided into four parts. The first addresses the topic of educational change, then it sets out a panoramic view of the innovation and educational change processes and finally it discusses the aspects and factors involved in any educational innovation process.

2. About the educational chage

Educational change is not new. It has been discussed for many decades worldwide. The nature of change, due to advances in different disciplines and the impact of technologies on society, is multiple and profound. It affects production systems, power relations, politics, culture, and education, causing transformations.

The culture of the 21st century demands various types of literacy: audiovisual, digital and information literacy. The educational paradigm moves to incorporate distance learning, mixed learning and collaborative learning. The media is changing the way we interact, present ideas and information, and communicate.
The demand for training involves serving new learning and competencies in virtual and personalized learning environments, accompanying the development of training throughout life.

In Mexico, Frida Díaz Barriga, a teacher at UNAM, in her article titled "Curriculum Reforms and Systemic Change" (2012) indicate that since the 1990s, curricular innovation processes for educational transformation have been developed with a series models, changes with great educational potential, aimed at achieving educational quality (p. 23-40). However, a centralized and top-down implementation approach continues to proliferate in reform processes without articulating a dynamic of systemic change. One of the problems highlighted by the author is the lack or insufficient information regarding the processes and implementation conditions of the changes, which prevents its successful development in the diversity of contexts in which its implementation has been intended. This has led to educational actors not wanting to get involved in the processes and if appropriate, they do so by obligation, but not with the conviction that these changes will transform educational beliefs and practices to meet the demands of the society.

Changes usually come from top to bottom and from outside to inside, with the aggravation that teachers see it as mandatory. In this regard, Murrillo and Krichesky (2012) argue that "change is not linear since what happens is that each phase can have retroactive effects or alter decisions made at an earlier stage" (p. 4). These processes of change, which can be part of education reforms, have been carried out globally and respond to the growing and globalized knowledge society, the incorporation of ICTs, international models, economic-business; proposals aimed at quality assessment linked to education funding, certification and accreditation. This is accompanied by the difficulty that these quality standards are unified and general and the social, cultural and institutional diversity of each community are not taken into account.

3. Innovation and change processes: overview

Questions arise in the actors and managers of educational change as to whether the models that have been applied for decades, can be considered as innovations or are trends or educational developments of the moment, for example, the orientation of the curriculum by competencies. Hence the importance of knowing the model and reflecting on the implications of these innovations in the educational work.

However, the change is inherent in the evolution of society. In this sense:

> The evolution of humanity is inherent in the notion of change in every aspect that characterizes it: the production of subsistence goods, the models, the methods for their exploitation, the distribution and consumption of goods, the health-disease process and its care, the socialization, communication, art and leisure, among others (García-Quintanilla et al, 2015, p. 47-48).

It is stated that there have been continuous processes of change since the beginning of the existence of human beings, which allowed growth and development in all aspects of society such as the production, politics, personal, communication, art, among other elements for better personal, family and communal living conditions (García et al., 2015, p. 47-53), argue that social change is a theoretical construction with two types of processes:

- Those who maintain the structure
- Those who tend to change.
-

The two processes can be presented on different aspects at the same time. As an example, they point out that parents can teach their children the customs with which they were formed, and at the same time they can teach their kids behavior patterns that allow them to better adapt to the new social structure. Change is considered not a fashion but a theoretical structuring organized by social thinkers in each age (García et al. 2015 p. 48).

As mentioned by Breilh, (2017), Higher Education undergoes a process of change to adapt to a new reality, it has a strategic role to fulfill, establishing sustainable development processes, leaving behind traditional models, creating more advanced university currents according to the different moments that characterize a change of era. It is the responsibility of university institutions to enhance the development of new streams of thought that give way to a new university ethos.

There is no doubt that society at the global level, and especially Ecuadorian society, demands emerging changes in higher education; it has been a need to comply with the most substantial of the Bologna Declaration for Higher Education (1999) where emphasis is placed on curricular reforms, title approval, lifelong learning, access to study opportunities, and training and promotion of mobility. This process allows obstacles to the effective exercise of free trade, new methodologies and financing, in order for the academy to generate processes of change that are in agreement with a dynamic society in constant transformation.

Part of these processes of change go through the analysis of the agencies that run Higher Education and firmly undertake a recovery process of university autonomy, understood as the particular dialectical relationship established between the state and the university (Tünnermann, 2008, pp. 314-315), as well as the independence of universities from the state and government, their capacity for self-government and administration.

On the educational change, Murrillo and Krichesky, (2012), state: "Educational changes are processes that develop in an educational organization or institution, involving several factors simultaneously and sequentially, phases or stages continuously and permanently developed" (p. 28). Indeed, when changes in institutions involve aspects that affect culture these do not occur in a single moment. Its complexity involves various stages ranging from

recognition to acceptance and adaptation. Every transformation process is a challenge in the implementation and evaluation and the expected results are not always obtained, because it depends on several factors, among them the difficulty in learning and applying the constructs and collaterally understand, facilitate and measure the dimensions of change processes (Hall, 2014, p. 99). Factors such as ignorance, understanding innovation and participation in implementation are decisive for the adoption of change processes in organizations.

Research on educational change highlights the works of Michael Fullan (2002a) who since 1960s conducted researches related to the study and practice of educational innovation in Canada. He called that early era "the era of adoption" (1972-1982) because he considered that the changes that initiated in the educational context were intended to import innovations to achieve educational improvements. The intention was to improve education, especially in the U.S., as it was considered to be low compared to other countries, especially the Soviet Union. The main focus during this period was innovation and not teachers. There was little awareness that innovations created uncertainty about the roles that teachers had to assume, and that this would mean certain unlearning and relearning. At this time according to Fullan (2002a), "there has been very little change in education and the protagonists have little impact in this process, being considered as 'passive adopters'" (p. 6), i.e., at this stage the model refers to teachers as the users.

The next decade (1982-1992) is called "the decade of meaning". At this stage the change is observed as a whole from all edges, especially from those who will apply it. Another feature of this stage is the vision of changes as part of a process that includes the initiation, deployment, continuation, and result phases. Fullan (2002a) believes that "although it was still a linear process, there was at least two-way side between each phase" (p. 7). It is no longer merely the adoption of an innovation but a complex process of transformation in the educational field. In this case, the teacher interacts with the other elements in each of the phases.

This decade emphasizes the meaning of innovation and teacher preparation for the expected results. Fullan points out (2002a), "If change is to succeed, individuals and groups must find the way of what they want to change and how to change it...", (p. 7).

Starting in 1992, Fullan has been talking about the "decade of the capacity for change". In this decade, Fullan writes the first series about the process of change, in which he states, is there anything worth fighting for? It basically integrates guidance and recommendations to teachers who face difficulties in implementing change processes.

Beginning 2002, Fullan wrote a trilogy to document the processes of educational innovation. The first book called, "The Forces of Change: Exploring the Depths of Educational Reform" (2002a), in which he emphasizes that a person by engaging in the depths of change also becomes part of it. In this sense, he notes that "we learn that it is not possible to solve the problem of change, but that we can learn to live with it in a more preventive and productive way" (p. 7). The second book is called,"The Forces of Change: The Continuation" (2004), aimed at studying the dynamics of the process of change based on an important empirical component that allows to demonstrate the evolution of internal and external reform and propose new prospects for the improvement. Fullan (2004) says: "We will analyze in depth the role of knowledge in the organizations, as well as knowledge and external connections" (p. 9). The third book is titled "The Forces of Change by Far" (2007) which highlights the continuation of studies on the process of change and states a new proposal that will try to change the context rather than accept it as something known.

In addition, it emphasizes the importance of the sustainability of reforms, establishing the need to consider the best conditions for them to endure.

In general, the level of changes in education processes and labor markets as Rama points out (2015), "... shows the way education systems operates, creating necessary changes and opportunities for investment, innovation and the development of new management models" (p.23).

As stated in the doctoral thesis "Teacher concerns at the implementation of curricular redesigns in the education careers of Central University of Ecuador" (Páez, 2018), this millennium undoubtedly means facing changing times; and in these new contexts education must be conceived differently and research should be carried out at all levels to diagnose critical knots and promote changes, which can be made through reforms that generate transformations in the organization of knowledge, the learning process and academic management, always considering the new epistemological horizons, new social, political and cultural scenarios.

As mentioned by Fullan (2002b), the change is mandatory in education, teachers must have different background training; educational institutions and the system itself must change in the training of future teachers; methodologies should be established to relate the environment and the community; reculturization must be promoted, i.e., transforming the habits, skills and practices of educators and promoting the creation of new actions. Change should not be imposed; these processes should not be handled isolated. It highlights the need to establish connections, networks, to enrich the proposals, to know the strengths and weaknesses of the proposals and to solve the problems that arise.

According to Beraza and Zabalza, (2012), "Innovating is doing justified changes" (p. 28), referring to the fact that superficial changes do not benefit the interlearning process. Therefore, profound changes must be considered to impact and benefit the educational community and society. These changes must respond to the specific needs and demands of the environment.

At the same time, as Osorio and Pech (2007) show us, we should not consider the processes of change from one direction. "Changes should not be addressed from a single perspective, either as government policy or as a result of the school's initiative, but from both directions and in conjunction with the surrounding social, technological, economic, etc. forces." (p. 175). This gives us, on the one hand, a rather complex view of what the processes of change actually entail and the factors involved in their development.
On the other hand, it is important to consider that any process of change, innovation or curriculum reform must be known, built and implemented by educational actors, i.e., by teachers, considered as agents of change. Unfortunately, the actors in the process receive the information when they have to implement the changes, generating a number of concerns, uncertainties, discomfort and resistance, having an impact on their implementation. As Rutherford and Hall (1990) have pointed out, changes are favored to the extent that they seek to respond to a lack of institutional need; they present to the institution and key players clearly express the two sides in their complexity and feasibility and explain their scope and diversity. Partial or total reform or innovation will work if there is training by teachers and the new curriculum proposal corresponds to the broader concepts of innovation, i.e., that they are well-founded, organized, contextualized, viable and practical

In this regard, Havelock and Huberman (1980, p. 49) point out that:

The fragility of the innovation process considered as a system makes a deep knowledge of the characteristics of its operation, essential in relation to the context in which it is developed. An innovative project can fail for a variety of reasons and only careful and ideal planning can give innovation some assurance that it will be in a position to coordinate the system and keep it running (Havelock and Huberman, 1980, p. 49).

Consequently, if reforms are imposed from the external or internal higher authorities of the IES (Higher Education Institutions), concern and even resistance will be created. It is therefore essential that actions be carried out concerning socialization, awareness and acceptance by teachers, along with conceptual and practical preparation on educational innovations. Teachers must be trained to achieve conviction levels that innovations understand, can apply and understand their scope.

Educational innovation is a deliberate and planned act of problem solving that aims to achieve higher quality in student learning, surpassing the traditional paradigm. It involves transcending academic knowledge and moving from passive student learning to a conception where learning is interaction and is built among all (UNESCO, 2016, p.3).

Innovation is the most suitable way that educational institutions respond to the requirements of a society, to its current complexity. According to Villavicencio (2017) there is currently the requirement of higher education institutions, especially the educational careers in which future teachers of all levels of education in Ecuador are trained to introduce alternative modalities of curricular designs that consider current social demands, the harmonization of new epistemological horizons, the growing and accelerated change that is being operated in science and technology, in order to respond to the new challenges that human beings must face in the rapidity and depth of the changes that are taking hold in life itself, in families, in institutions, in society. According to Pérez (2012) "The confluence of such significant and radical changes is shaping a new target context that changes the institutions, states and daily lives of citizens within an era of globalization and interdependence" (p. 49). The new target context concerns the new political and economic relations of the nation-state, the globalization processes in the environmental, cultural, political and interdependence related to the coexistence of new different human groups and up to the environments that determine the complexity of the context.

In these processes of change, society, public and private educational institutions and teachers must be involved, and teachers must participate decisively and directly. Educational institutions should focus their attention on the main agent of innovation processes, they should know their thoughts, expectations, personal and professional interests, the training received, skills and preferences.

In the research of Beraza and Zabalza (2012), dedicated to the institutional and organizational dimension in educational innovations, the authors highlight the main role of innovative teachers in the implementation of innovation. The decisive role of institutional culture in terms of the perception of teachers who are part of the institution is highlighted, perception that manifests itself in the meaning and value that teachers attribute to innovation. The process of change is difficult to understand and accept, even more so if the person, agency or institution has not been invited to participate in its construction.

As mentioned by Fullan (2002b), educational reforms risk failure to implement if the basic elements such as the evaluation of previous processes of change are not considered, determining their strengths and weaknesses; furthermore, if the actors of change are not

taken into account or if other factors such as politicians, religious who want to impose trends aimed at the fulfilment of other interests are involved, distant from the quality of education and the comprehensive training of future professionals.

When talking about changes, the terms change, reform or innovation are often used interchangeably. It is then necessary to clarify the meaning of these terms. Casanova (2015) summarizes the meaning of the three terms as follows: "change as the fact of stopping doing one thing to do another, reform such as doing again, modifying situations to correct and improve them and innovation as the alteration of something to introduce novelties" (p. 17). Casanova (2015) defines innovation as "the incorporation of something new into an existing reality under which it is modified" (p.20).

According to Fullan, (2002b) change is multidimensional and it involves at least three components: the use of teaching materials, new teaching approaches, and new theoretical approaches. And he states that "... the problem with much of the literature so far is that it emphasizes on innovation and not on the user (parents, teachers and students)" (p. 4). In this regard, it emphasizes the study of the methodology that is the object that should cause the change and not on the effects that the object causes on the users. Undoubtedly, education must respond with permanent inclusions and continuous processes of change that require will, commitment, enthusiasm of teachers, in order for an effective participation during the process that ranges from the construction of innovations, their implementation and evaluation.

Murrillo and Krichesky (2012) argue that "possibly one of the worst sins of education is complacency: whoever believes that he already does well, that he does not need to improve, is on the way to doing it wrong and getting worse" (p. 27). In any process of social change, it can be mentioned that if we do not move forward, we go backwards.

To carry out any process of change especially in education, things must be considered as its complexity, know the stages that compose it and know how to anticipate the own resistances that originate in teachers in the face of these processes. In particular, teachers' concerns should be identified in order to establish the necessary actions to overcome personal problems, and start the process of change, innovations with better guarantees of sustainability and efficiency. In this sense, the studies carried out by Hall, G. and Hord, S. (1987) are significant, setting out the stages of concern of teachers in the face of innovations.

As mentioned by Casanova (2015) it is necessary to establish processes of change, innovators and emancipators for the construction of a public policy and the development of institutional reforms for higher education, which allow the establishment of new scales and evaluation protocols, quality assurance (not accreditation). It is also necessary to establish new educational models, curricular proposals, pedagogical strategies for undergraduate careers and postgraduate programs. Added to this is the need to respond to the creation of different systems of admission and leveling, eliminating those that deepen the structural and historic social gaps that leave out thousands of high schools each year of higher education, becoming part of a population group that does not have the opportunity to forge a promising future due to the impossibility of achieving a place in public universities and also achieving decent work.

4. Aspects involved in the educational innovation

The definition of educational innovation is unclear, there are many definitions. For example, Rogers (2003) notes that "innovation is an idea, practice, and object that is perceived as new by an individual or adoption unit" (p.20). In this sense, any element that appears and alters

the image that individuals have of the environment is considered as innovation. In education, it refers to the incorporation of devices in the classroom, a new practice, a methodology, a new instructor. At the same time that it can be considered as the modification of the physical space, the incorporation of stimuli such as colors or sounds, etc. As can be seen the meaning is very broad and many aspects can be considered as innovation from it.

García-Quintanilla et al. (2015), declare that educational innovation constitutes a novel and major work aimed at completing or creating a system or processes of intentional change, consisting of a project or a set of activities that are part of a project (p. 50). It is sometimes considered as synonym of change, but it is not; it can be seen that they are closely linked to each other, as innovation produces changes which are considered special to them, as they constitute a deliberate effort which has as its main purpose the improvement of the system.

Beraza and Zabalza (2012) define innovation as "deliberate effort to obtain significant improvements in the system" (p. 46). "It is a novel and major work aimed at completing or creating a system" (p.47). A society permanently seeks to improve and to make the most of the results in all areas and for this purpose new processes, strategies, activities are resorted, to make it possible to achieve that desired change. In the case of educational innovations, these are processes that arise aimed at introducing fundamental changes in a relentless search for solutions to the problems faced by institutions directly related to social changes, paradigms, new pedagogical approaches.

Educational innovation identifies with an action or actions of change that are intentionally performed in education as part of a project. Tejada (1998) mentions that “any innovation is always a deliberate action and that this experience must be conceived with complete rigor” (p.13). Citing the intentionality, systematization, contextual dimension, substantive dimension, personal dimension, process dimension and evaluation dimension as conditions for the fulfillment of the objectives in an institution.

Referring to educational innovation suggests that the meaning of the term innovate needs to be revised, because while it is true that in education there is an effervescent world of innovations, they must be applied with analysis. What innovation means and what is not, "to innovate is not only to do different things, but something better than the above" (Beraza and Zabalza, 2012, p.19).

In order to develop processes of educational innovation, there must first be a decision to innovate, then the understanding of the process, the analysis of information, the setting of priorities, the visualization of the situation, the definition of strategy, plan implementation, evaluation and change management (Ortega et al, 2007).

There must be the direct participation of educational and social actors, teachers and students, the entire educational community in the construction of innovations. As is currently the case in Ecuador, these changes are imposed, as are regulations that stifle higher education institutions, as they respond to a technocratic, linear, concentrator model based on hegemonic, which have made IES and teachers to be on an elitist education of an individualistic meritocracy, creating spaces for a national and global phenomenon. According to Villavicencio, (2017), the rankings often have perverse effects since they can affect certain social groups, educational institutions, blur the vision of academic management (research, teaching and linkage) giving way to administrative concerns (filling matrices and accumulating evidence).

Change, innovation, education reforms are imperative, but these must be built with teachers, with the entire educational community, and strategies must be established to enable them to be implemented.

Referring to the Rogers innovation process (2003), it presents the following steps:

Scenario	Definition
Knowledge	Innovation is known and understood
Persuasion	An attitude is developed for or against innovation and it is argued
Decision	Innovation is accepted or definitively rejected and the process is not continued
Implementation	The implementation of innovation is tested
Confirmation	Acceptance of the innovation

Table 1. Stages of the innovation process. Source: (Rogers E. 2003. Diffusion of innovations)

The stages of the innovation process presented by Rogers (2003) clearly state that an innovation process, especially curriculum, involves the management of information in a broad, clear, correct and defined way, information that allows teachers to reduce uncertainty caused by misinformation regarding changes to be adopted. Potential knowledge will allow to understand innovation and have the necessary arguments to take a stand against change and decide whether or not to adopt it. If it is favorable, the decision will continue with its implementation, which will be determined by the complexity of the structure and resources available to the institution for its implementation and with the conviction of its functionality, opportunity and relevance, aspects needed to achieve transformative and impactful action in the multiple fields of the educational institution and society.

Undoubtedly, as mentioned by Ortega et al. (2007) when making changes, it is important to have innovative teachers prepared to develop change strategies and reforms, based on research and linkage, ready to carry out collaborative, inclusive work that develop its management in internationalization and virtualization learning processes, conditions that are essential if innovation is considered not as a formal bureaucratic compliance with what is imposed by the administration of higher bodies or authorities.

Innovation processes in their implementation have adverse factors that often make it difficult to meet expected targets. Havelock and Huberman (1980) refer to six adverse factors to the innovation process:

> 1. Underestimating the innovation process: insufficient coordination and communication.
> 2. Personal conflicts and motivations: opposition to change, personal motivations, difficulty understanding others.
> 3. Underdevelopment: negative conditions in resources, insufficient materials.
> 4. Financial problems: insufficient financial input.
> 5. Opposition of influential groups: opposing ideas of power groups, of the leadership group.
> 6. Bad social relations: lack of harmony among members, difficulty in relationship, contrary ideas (pp. 304-323).

Indeed, the implementation success of curricular innovations depends on the adverse factors to innovation being evidenced, in order to overcome them in the educational institution. It should be thought that there must be sufficient coordination and communication with teachers before starting the process of change, so that they know, discuss its application and familiarize with it. It is also necessary to develop a motivation process to overcome attitudes opposed to change, knowing the reasons and analyzing them. Sufficient human, material and financial resources must be available to meet the requirements and to hold working meetings to find agreements and harmony among the actors linked to the process.

It is important to note that good intentions on the part of authorities and teachers is not sufficient to achieve the expected success with the proposed innovations. Teachers need to assume the innovative project as their own and commit themselves to the processes of change and co-construction that promote and strengthen a quality education, updated at the scientific, technological, curricular, cultural and citizens. Educational institutions generally develop processes of change, introduce innovations, new programs, practices, curricular designs, with the intention of generating better results for students, for the community, processes that involve difficulties in its implementation and not always achieve good results, sometimes the results are even unfavorable. When that happens they often test other reforms or innovations, ignoring to know and understand the causes that failed to meet the expected objectives.

Century XXI requires that education be developed with a new vision; education bodies, educational institutions, educational and pedagogical models, curricular designs, their programs should be transformed, in particular, the training of the teacher must change in order for his performance to respond to the new epistemological horizons, to the new challenges determined by complexity, modernity. In this regard Fuguet (2015) says, "Undoubtedly, an educational challenge is to be able to face the continuous changes in technological advances, especially those related to those to communication and information" (p. 100).

With regard to the university teacher, Mas-Torrelló and Olmos (2016) should be considered a professional in constant process of change, due to epistemological, paradigmatic transformations, referring for example to not focusing attention on teaching and the teacher, but to focus on learning and students, social, cultural and structural changes, new curriculum designs, review of methodologies used, new models of assessment, accountability, the application of new regulations by referring to laws, regulations, instructions among other aspects, and to agreements, resolutions, mandates of national and international conventions that recommend on the requirement for profound changes for the quality and internationalization that must be assumed by the universities (Mas-Torrelló and Olmos, 2016).

This reality leads to changes in the roles and tasks assigned to the teacher and the need to adopt new competences to efficiently develop their professional functions, which in turn gives rise to the need to establish pedagogical training plans for continuing education and updating aimed at defining and guiding new roles in the fulfillment and articulation of the substantive roles of the teacher in the different scenarios demanded by education in this century. Innovation is then constituted as a change that has an effect on structural and functional aspects of education to improve its quality.

With regard to teachers' concerns about curriculum innovations, Hall and Hord (quoted in Marcelo, Mayor and Sanchez, 1995), say that "a concern would be the representation composed of feelings, concerns, thoughts and considerations given to a particular issue or task" (p. 154), in consideration of the fact that each teacher perceives situations differently in relation to the event he faces in accordance with his own development scheme.

Concern means a state of unease and fear caused by a problematic situation. If this state is presented in processes of change and innovation, it can become an obstacle at the time of implementing reforms or innovations, and the results will surely not be as expected, risking failure, as these can be adopted or rejected individually or collectively.

People, experiencing the changes, have many questions about how they will affect them, how they will do it, and what impact it will have on students, the institution; they have skepticism and disbelief about the usefulness and validity of processes and those who direct, including mistrust, questions that since are not answered can generate resistance, indifference, demotivation and even opposition, all of them considered determining factors when implementing any process of change.

Fullan (2004) argues that in order to succeed in the implementation of an educational change process, it is appropriate to understand and merge the intellectual, political and spiritual strength, which must be developed and combined. Intellectual strength, referring to the creation of knowledge about the process of change; the political force, which establishes collaborative work processes with internal and external alliances; and the spiritual strength or moral purpose involved in provoking debate and commitment to change. Concluding, Fullan (2004) says: "It is also clear why we need the fusion power, i.e., that all three forces interact and combine to achieve maximum effect" (p. 97).

5. Factors that must be involved in the educational change

The process of educational change begins with the identification of a problem and in the case of higher education in Ecuador, the agencies that run these made assessments in which a number of problems and serious questions were identified, as set out in the report of the Higher Education Council (CES, 2014).

In this context, it is worth noting that García-Quintanilla et al (2015), present three basic principles that should guide the processes of change in education:

> 1. Increase in the democratic participation: the direction of processes and activities should promote an exercise freer of opinion and the emergence of initiatives through a process of full communication.
> 2. Critical assessment: aimed at knowing and analyzing what is done and how it is done.
> 3. Motivation: in the process of change there should be an opportunity for greater professional involvement of the staff, based on motivational activities (p. 49).

Changes in education are a complex process whose stages must be known to those who will apply them. In addition, leaders should anticipate potential resistance attitudes and establish strategies to initiate, execute and evaluate the process and support its effectiveness and sustainability (Murrillo and Krichesky, p. 27).

Fullan, M. and Levin, B. (2009) in a research conducted in Toronto, Canada, state that the change in education must be politically driven by leaders who must understand, accept and participate by establishing a set of fundamental strategies of the entire reform system. They raise six bases:

> 1. Development of the teaching profession: the basic premise is respect for teachers and professional knowledge. Reform cannot be implemented unless all teachers are working towards the same goal. In addition, a combination of labor peace, stability and incentives is needed for the profession to develop.
> 2. Establishment of measurable objectives in collaboration with all: it is necessary to establish specific goals in partnership with all involved, whether institutions or groups of teachers.
> 3. Maintaining a two-way path between instruction and evaluation: good instruction should lead to evaluation and an evaluation should lead to good instruction. Both must allow capacity development.
> 4. Recognize leadership as a key element in the process of change: effective leadership of all participants with leadership roles must be encouraged.
> 5. Establish comprehensive intervention strategies: based on motivation to all staff immersed in the process of change in order to develop comprehensive collaboration.
> 6. Allocate resources for all projects and use existing ones: it involves putting the required economic resources, in a focused way, at the service of the execution of the projects (pp. 30-31).

Regarding the educational change at the Ecuadorian university, Ramírez (2016), says "this is perhaps one of the main challenges that the Ecuadorian university has; not only to convey knowledge but to have a critical-reflective, self-reflective knowledge generator, responsible for the common interests we have as a society, region and world" (p. 47). The change in higher education allows the development of society and thus the increase of the quality of life of human beings, because it is a cultural environment that makes it possible to discover and cultivate individuality and strengthen coexistence. The objectives are achieved on the basis of the transformations of universities to respond to the constant changes posed by the current global, regional and local context.

Educational changes involve many personal, behavioral and cultural factors that promote or hinder them. According to Sepúlveda and Murrillo (2012) these factors are:

> Personal factor: by resistances or obstacles that prevent people to be open to changes that arise from the beliefs that are formed throughout life. These are the mental models that condition certain ways of thinking and acting, even to consider that as the only truth.
>
> Behavioral factor: believing that people are not prepared for changes, because new ideas take away security or peace of mind and detract from confidence to continue with new learnings.
>
> Cultural factor: as each person learns and internalizes throughout life, customs, norms and behaviors that influence his life (p. 8-9).

It is important to note that in the development of any process of educational change, internal and external factors to the institution and especially teachers should be considered, since not doing so can determine that the action is taken in the opposite direction, which will surely generate resistance or indifference and/or fears that can alter the process or limit the scope of innovation.

In short, it seems that the tendency is to do collective work in terms of significant changes that revolutionize education as a response to the myriad problems affecting the world's societies and in particular Latin America. A path must be opened to advance educational, pedagogical, curricular, methodological changes, being aware that a change in education is imperative and should be applied in order to achieve a quality, contextualized, modern education for diversity, interculturality, equity and inclusion, which is sustainable and can be generalized.

6. Conclusions

It is necessary for the community to create a proposal to develop a process of educational change, in which the relevant elements are integrated and articulated from the philosophical, epistemological, sociological, psychological, pedagogical point of view; project principles and objectives; strategies including teacher training, among other elements. These aspects make it possible for teachers to be involved and get excited by being an active part of a large project.

A factor that is often overlooked in the processes of change is the human element, since teachers are not considered to be educational actors, professionals who actually do the work. In addition, it is generally not taken into account that each person responds to a new process with attitudes and beliefs, with a personal and professional record of their own, a fact that determines that each acts differently from the processes of change. The change of mindset is fundamental in all these processes, because without existing it, there is the risk of finding defensive, superficial, ephemeral success attitudes (Fullan, 2002b, p.15).

When referring to educational change, it must be understood that it does not only affect the school system, but also the people involved who have different perceptions, attitudes, feelings and concerns, which must be considered in order to achieve a management that facilitates and drives the process of change that according to Hall (2014), takes three to five years for it to happen. In this regard, Osorio and Pech, (2007), point out that " there is a broad consensus in the face of educational reforms that these are not sustainable if the actors involved do not participate in their design and implementation..." (p. 174)

It is undoubtedly necessary to address the process of change from the perspective of teachers, from the concerns generated from the reforms or innovations that are in place to be implemented, if it is considered that they are the direct actors of the implementation in the classroom, in the institution and that it is essential to accompany the professionals on this journey to support and strengthen the process.

Finally, it is confirmed that teachers' concerns regarding the reform should be known in order to predict and determine actions for the preparation, training, guidance, assistance and resources needed for the implementation (Marcelo, Mayor and Sánchez, 1995).

There are validated instruments in other researches (Martínez, 1999, Páez, 2018) such as Frances Fuller's Concern Based Adoption Model (CBAM), which is a basic adoption model

focused on concerns that teachers have in the implementation of a process of change, reform and innovation in the area of education.

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REVISTA CÁTEDRA

Los rediseños curriculares en las carreras: un diálogo abierto en la Facultad de Filosofía, Letras y Ciencias de la Educación

Academic program redesigns in careers: an open dialogue in the Faculty of Philosophy, Letters and Education Sciences

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Resumen

El propósito del estudio fue identificar las percepciones de estudiantes y docentes sobre las dificultades de la implementación de los rediseños curriculares en la Facultad de Filosofía, Letras y Ciencias de la Educación de la Universidad Central del Ecuador, para lo cual se tomó como base para el análisis las funciones sustantivas de la educación superior que son: docencia, investigación y vinculación con la sociedad. La metodología contempló el enfoque naturalista de carácter exploratorio y descriptivo, se utilizaron técnicas cualitativas y cuantitativas para lo cual se elaboró un formulario de encuesta en escala de Likert y una guía de grupo focal. La investigación consideró aspectos como: participación de la comunidad educativa en la elaboración e implementación de los rediseños curriculares; la docencia, la investigación y la práctica preprofesional en los rediseños; el aporte del proyecto integrador de saberes y las prácticas de aplicación y experimentación al perfil de egreso. Los resultados evidenciaron que en la elaboración e implementación del rediseño existió una limitada participación de los actores clave, además se evidenciónuna deficiente orientación pedagógica y curricular. Esto se expresa en debilidades sustanciales en los campos de especialidad y de formación docente, en las mallas curriculares con asignaturas de alta carga horaria, que no corresponden al campo específico de la especialidad;así como también,la poca comprensión sobre los alcances y objetivos del proyecto integrador de saberes.Una de las conclusiones más importante apunta a una reforma integral a los rediseños curriculares de las carreras que respondan al perfil de egreso en coherencia con los lineamientos pedagógicos, epistémicos, metodológicos y axiológicos de la Facultad.

Palabras clave

Carreras, docencia, especialidad, investigación, práctica preprofesional, rediseño curricular.

Abstract

The purpose of the study was to identify the perceptions of students and teachers about the implementation of the academic program redesigns of the Faculty of Philosophy, Letters and Education Sciences of Universidad Central del Ecuador, considering that the redesigns aim to develop new capacities in the students of the Faculty, framed in the three substantive elements of education teaching, research, and connection with society, which express serious limitations in the institutional intentionality of reorienting the process of professional training in the eight education careers of the faculty. The methodology used was qualitative, exploratory and descriptive, qualitative and quantitative techniques were used, for which a Likert scale survey form and a focal group guide were elaborated, aspects were considered as participation of the educational community in the elaboration and implementation of curricular redesigns; the development of teaching, research and pre-professional practice in the redesigns; the contribution of the integrating project of knowledge and the practices of application and experimentation to the graduation profile. The results show that there was limited participation of the actors, deficient pedagogical and curricular orientation in the elaboration and implementation of the redesign, expressed in substantial weaknesses in the fields of specialty and teacher training. There are subjects in the curriculum with a high workload and without any relationship in the specialization field, there is also evidence of a lack of understanding of the scope and objectives of the integrating knowledge project. One of the most important conclusions points to an integral reform to the curricular redesign of the careers that responds to the graduation profile in coherence with the guidelines of the Faculty.

Keywords
Teaching, research, pre-professional practice, curricular redesign.

1. Introduction

This article aims to identify the perceptions and assessments of students and teachers regarding the implementation of academic program redesigns at the end of the fourth semester of their implementation. This study covered topics such as the participation of authorities, teachers and students, the substantive functions of educational work: teaching, research, and linkage, as well as the application of the knowledge-inclusive projects (PIS) and the implementation and experimentation practices (PAE) that support the teaching and learning process

The Council for Higher Education (CES), the National Department for Higher Education, Science, Technology and Innovation (SENESCYT), in the framework of public policies in higher education established the legal regulations that required universities to restate educational processes under the guidelines of these institutions. These provisions for the elaboration of academic program redesigns were adapted almost literally by the Faculty of Philosophy, Letters and Educational Sciences.

Although the careers have a limited pedagogical and curricular orientation, they were in charge of planning the curriculum redesign oriented by the guidelines determined by the education agencies: CES and SENESCYT. For the education careers, a generic curriculum model was established and was the mandatory guide for the development of redesigns. The generic model included curricular units, fields of study and most of the subjects with their corresponding time load in the curriculum. In this context, curricular redesigns are created and approved in accordance with current legal regulations; firstly, the internal bodies of Universidad Central del Ecuador (ECU), and then the external ones constituted by CES and SENESCYT.

Due to the implementation of curricular redesigns, the Research Commission conducted this first diagnostic study by the request of the faculty authorities, identifying the main critical problems in the teaching-learning process. Situations such as limited student participation in the implementation of the redesign, lack of communication between actors, content of subjects and time load do not contribute significantly to the professional profile. Thus, the results of the study will help the decision-making of the authorities to make the necessary changes in the redesigns.

This article is structured as follows: the first part is purely theoretical in which the main conceptual lines and characteristics of academic program redesign in higher education are developed, taking as a case study the careers of the Faculty of Philosophy, Letters and Educational Sciences; the second part describes the methodology used in the study; the third part presents the analysis, interpretation, and discussion of the results on the implementation of curriculum redesigns; and ends with conclusions as reflections to open the debate.

2. The curriculum in higher education

2.1 Curriculum, definition and relevant data

Higher education institutions (IES) aware of their role and responsibility to society set the direction of the public policies of education systems and the equity in which their benefits are shared with the population. They are also the engine to address the effects of

globalization, the new social labor division, as well as the incorporation of new metrics beyond the Gross Domestic Product (GDP), that promote inclusion and equality in a pluralistic and democratic political and sociocultural context.
From this perspective, the University must be constantly renewed, leading to a restructuring of careers, curriculums, their epistemic, philosophical and methodological content in the framework of the development of authentic, free and democratic thinking. This will only be possible with relevant redesigns created on the basis of the country's social needs and development requirements.

Academic program design in higher education is a process of organizing and planning the training of professionals in the different fields of knowledge, and it also responds to its own internal dynamics and the socio-cultural conditions of the country. It requires deep analysis and reflection by the educational community in order to enhance and strengthen the individual capacities of the student and to promote the productive, economic and social development of the country.

There are several conceptions on the curriculum in higher education which depend on the strategic axes, the purposes of education expressed in a pedagogical and training project that contributes to the transformation of society. This study refers to the definition of Larrea (2015):

> The higher education curriculum is a social and collective construction, based on a continuous research and evaluation process of trends in science, society, profession and the construction of interactions of educational actors. It expresses and defines the purposes of education, and promotes an action plan carried out in a pedagogical and training, critical, dynamic, participatory and creative project, oriented to generate learning experiences that produce an approximation between knowledge, reality and the production of meanings of the educational individual, developing a series of knowledge and competencies that affect his/her personal, professional and citizen identity in the framework of a particular productive, political, social, environmental and cultural context, leading to his/her transformation (p. 20).

The demands of today's society in the training of professionals must respond to the highest levels of scientific knowledge, the management of methods and methodologies that use information and communication technologies to support the teaching development process and the ability to respond to the demands of the Ecuadorian education system. These requirements, are essential to guide reforms and transformations in the curricular redesigns of the careers. Aspects that are rescued by Carrión (2002), by stating "that the cornerstone of substantive changes in education is in the conception of curriculum design" (p. 21).

Likewise, Durán et al. (2018) state that "the curriculum must be conceived from a dialectical projection that responds to the requirements of the social context through actions of teaching, research and linkage, intervening rationally in the formation process of professionals" (p. 7). In other words, the curriculum contains important aspects for the academic and institutional life of the university, therefore its design should encompass visionary strategies that in the long term are reflected in products that account for comprehensive training, i.e., profiled according to the demands of today's world.

The various proposals arising from the reflection and social commitment attached to the curriculum from a globalized and interdisciplinary perspective had as background the interest in achieving an integration of the various fields of knowledge and educational practices that allowed for the more thoughtful and critical understanding of reality. This implies an overcoming of scientific and subject-based content in the transition to a dynamics of processes that enable the creative appropriation of science and, at the same time, the understanding of how knowledge is produced (appropriate) and transformed. In this regard, Torres (1998) emphasizes that:

> The globalized and interdisciplinary curriculum becomes a category capable of grouping a wide variety of educational practices developed in the classroom and is a significant example to analyze the most appropriate contribution form to improving teaching and learning processes (p. 31).

In other words, the curricular models made by the bureaucrats who lead education and who are outside the concrete processes of daily educational work in the classroom, in the interrelationship between teachers and students, are questioned. Therefore, the redesign has a globalizing nature in which the orientations on the selection of contents and their way of organization in areas and subjects prevent reflection and debate, evidence of the influence of the scientific, bureaucratic and instrumental trend in the educational processes managed by the State. Torres (1998) shows other alternative ways of conceiving the curriculum:

> not only focused on subjects but on planning that revolves around the problematic nuclei. Here the student is forced to manage theoretical frameworks, concepts, procedures, skills of different disciplines to understand or solve the issues and problems raised (p. 31).

2.2 Academic program redesigns at the University

The construction of the University Academic Model starts from the consideration of the State rectory on public policy in higher education that sets out the strategic guidelines for its design and implementation. The curriculum is addressed from a multidisciplinary perspective that proposes the articulation of several disciplines that respond to complex problems that cannot be solved in isolation but in a dialogue between the knowledge. Also, a transdisciplinary logic that involves the integration of thought styles that incorporate in a transversal way new languages, problems, and purposes that exceed the individual departmentalized assigned (Larrea, 2015, p. 9).

The Faculty of Philosophy, Letters and Educational Sciences of the Central University of Ecuador started the design and elaboration of the curricular redesigns from 2015, following the provisions emanating directly from the Council of Higher Education (CES). Curriculum fields are at the heart of all the intervention to the student in which the actors and subjects, the knowledge, the methods and methodologies, contexts and tensions to be transformed are all together.

The field of study is understood as the set of integrated and coherently organized knowledge oriented to the understanding of the problems and thematic axes of the profession. These fields are as follows: (a) theoretical foundations; b) professional practice; (c) epistemology and research methodology; (d) integration of knowledge, contexts and culture; and, (e) communication and languages, the same that contribute to the integrative

chair and the PISa the pre-professional practice (Larrea, 2015, Comisión de Innovación, 2019, p. 4).

The curricular fields stated in the redesigns group the subjects or analysis units located in the nine semesters that last the professional training of the career. Likewise, these fields are organized in the basic, professional and titling curricular units. Achieving synchronized inertia of academic action requires collaborative academic work among the actors in the educational process.

According to Cisterna, Soto y Rojas (2016) to face the challenges of modern education with a transformative vision that responds to the demands of the knowledge society "requires a strong commitment of educational actors that allow the harmonization in order to consolidate serious policies for educational strengthening at all levels" (p.305). This process of curricular redesigns for education careers in universities aims at the professional training of qualified teachers to achieve significant learning in the student.

2.3 Discipline and interdisciplinarity: associated concepts in curriculum design

There is no agreement in the meaning of interdisciplinarity. For some people, interdisciplinarity is considered as the search for a great theory, as a new stage for the development of science, for the reunification of knowledge. For others, it is the mechanism that allows defining the boundaries of their respective area of knowledge, a criterion that has been surpassed in scientific reality by the creation of certain integrated disciplines necessary for a more stable understanding of reality.

What worths showing is that the object of knowledge varies over time depending on its context and the advancement of the science, deepening this episteme, expanding on knowledge, while restricting it because there is an uninterrupted differentiation process of the science, where there was only one science before now there are several that allow deepening that knowledge (Kopnin, 1966, p. 88).

Interdisciplinarity arises in the twentieth century on the basis of the existence of disciplines, mainly to respond to the need to correct the mistakes of an overly compartmentalized positivist vision without communication between its parts. This is surely due to its ambiguous limits that this conception generates among the sciences and, above all, to solve problems of reality that cannot be achieved if an approximation is made from a single field. The purpose of this is to have a multilateral view of the phenomena under study. Larrea (2015) points out:

> curricular redesigns must be underpinned by the epistemological rupture in the conceptualization of the new approach of knowledge organization to achieve meaningful learning by implementing innovative integration forms of scientific knowledge, incorporating inter and transdisciplinary models into the curriculum structure that exceed the assignment of different subjects and the limits of disciplines to build innovative strategies (p. 17).

Under this view arises the need to address curricular redesigns in higher education from an inter and multidisciplinary approach that sponsors the development of autonomous and realistic thinking. In turn, this enables the articulation of the substantive functions of higher education.

2.4 The foundations of the curriculum in higher education institutions

2.4.1 Teaching

Teaching considers that not any methodology is suitable to teach the different types of content since it is known that each discipline involves a method, a methodology and specific creative ways of developing the contents. In turn, dialogical and horizontal relationships in ecological interaction contexts between different teaching and learning systems. In this regard, Castillo (2010) says:

> The teaching profession brings together the deepest ethical sense of the concept, which is to perform or consecrate itself to a cause of great social and human significance, where action between teacher and student goes beyond self-interest and gives the opportunity to give oneself seriously in an educational cause that transcends the one who plays it (p. 902).

2.4.2 Research

Research is a key role in higher education. Ander-Egg (1995) "defines it as a formal, systematic, rational, methodical, and intentional process in which the scientific method is performed as a thoughtful and critical procedure" (p. 71). In the context of vocational training, formative research effectively contributes to the innovation of the teaching and learning process.

Research is closely linked to teacher training so the building capacity is strengthened by the effective articulation between teaching and the systematic and thoughtful application processes of the scientific method in research. However, in the university context, goodwill is not enough to do research as part of the curriculum, some mental barriers to traditional conceptions and practices need to be overcome, such as the unwillingness of higher education authorities to allocate sufficient budgets. In this regard, Ayala (2013) reports that:

> We do not have the resources to investigate, at least as we would or should do it, but that should not prevent us from finding the courage to think first about our research needs from our position in the world. Ecuador's university advanced not when it imitated foreign models, but when it solved its growth and development problems. That's our big challenge. Our main concern should be not depression or complacency. Neither is the complaint against the government and its policies. It must be the urgency to recover, from our own reflection, that the university is the headquarters of the reason (p. 71).

2.4.3 Relationship with the society

The relevance of the university has to do with the contribution it makes to society. We cannot speak of the quality of academic training and scientific production under an investigative line, without being inextricably linked to the sectors of social, economic and productive development. In other words, bonding drives the relationship of the university community with social actors in a permanent dialogue of knowledge that bets on social transformation. Barreno et al. (2017)

> define the relationship with society with teaching and research as the three main foundations of any University oriented towards the integral vocational training of students. This type of activity is the result of a planned action with an ethical commitment, and open to change (p. 34).

This definition is in agreement with the information presented by the Academic Guideline when saying that the relationship with society is articulated with teaching for the integral training of students, through the promotion of spaces of experiential experience and critical reflection; it also "articulates with research in the identification of needs and the formulation of questions that power lines, programs, and research projects; and by promoting the social use of scientific knowledge" (2019, Art, 4, literal (c).

3. Methodology

This study is qualitative since it tries to interpret the implementation reality of the academic program redesigns of the Faculty, according to the perceptions of students and teachers; i.e., that there was a clear understanding of the existing theory. According to Hernandez et al. (2014) "The qualitative approach, sometimes referred to as phenomenological, interpretative or ethnographic research, is a kind of support (which includes a variety of conceptions, visions, techniques, and non-quantitative studies)" (p. 16).

The design of the research is non-experimental and transversal since the variables were not manipulated. The relationships between the independent variable, curricular redesigns of the year 2016 and the dependent variable were described, perception of the relevant actors on the implementation in the period September 2018 – February 2019. This study was carried out in each of the careers of the Faculty of Philosophy, Letters and Educational Science. Depending on the scope, the study is descriptive, as the relevant aspects were examined following the steps of the scientific method.

The research considered the student population from the first to fourth semester, students who were coursing the redesign. The sample considered the following criteria: apply the survey to third and fourth-semester students of each career, alternating between morning and evening. A total of 443 students, 65.7% of women and 34.3% of men participated. To listen to the perceptions of the teaching staff, a focus group was organized with teachers and professors members of the Career Board and Redesign Commissions.

Two techniques were used in the collection of information: the survey targeting third and fourth-semester students and the focus group with teaching career representatives. The information provided was saved stealthily by the research team, which is contained in the archives of the Post-Graduate Office of the Faculty.

Sample per career	Frequency	Percentage - %
Social science	86	19.4
Psychopedagogy	52	11.7
Informatics	31	7.0
Physics and maths	35	7.9
Languages	56	12.6
English	58	13.1
Initial Education	74	16.7
Natural Science	51	11.5
Total	443	100.0

Table 1. Sample by Faculty careers

The processing and analysis of qualitative data used the discourse analysis by categorizing the main elements defined in advance by the study. The processing of quantitative data required the use of SPSS statistical software.

This study has semantic validity since the representation, relevance, and plausibility of the data was observed; hermeneutic validity, i.e., it was based on the theoretical basis of research, analysis, interpretation, and pragmatic validity through the descriptive relational implementation dynamic of the 2016 redesigns and their acceptance level of the students.

4. Analysis and interpretation of the results

The results of the research respond to the objectives set out in the study, aspects such as: participation of educational actors in the redesign processes 2016 were taken into account; curricular content for teaching, research and relationship with society, an integrative project of knowledge, and application and experimentation practices as fundamental axes that are part of the university work.

The analysis and interpretation of the results obtained in the survey consider as negative the alternatives: never, almost never and sometimes; whereas alternatives are almost always and always positive.

4.1 Participation of the educative community in the development and implementation of academic program redesigns of the careers

The survey on students, Figure 1, states that a considerable 86.45% did not participate in the discussions nor in the decision-making of the implementation redesign process of their careers. This response suggests that the traditional or vertical forms of educational management have not yet been overcome. The student is still considered as the object of intervention in which the responsibility of what, how and why the educational processes are decided at the higher levels between authorities and teachers. This intervention form has caused students not to take over the project, and consequently, there is little understanding of the purpose of the redesign.

In relation to the above, there was weak participation of teachers due to little information and commitment to the implementation process of the redesigns. However, in each of the careers, isolated efforts have been made that have led to the "ghettos" formation of teachers without an adequate guideline to guide the implementation process of the academic program redesign.

Also, the perception of students is confirmed, noting that students have very little involvement in the implementation of the redesign, "but the student claim is growing, because they feel that the subjects and the time load of the redesign do not respond to the teaching specialization" (Grupo focal, docentes, Enero 2019).

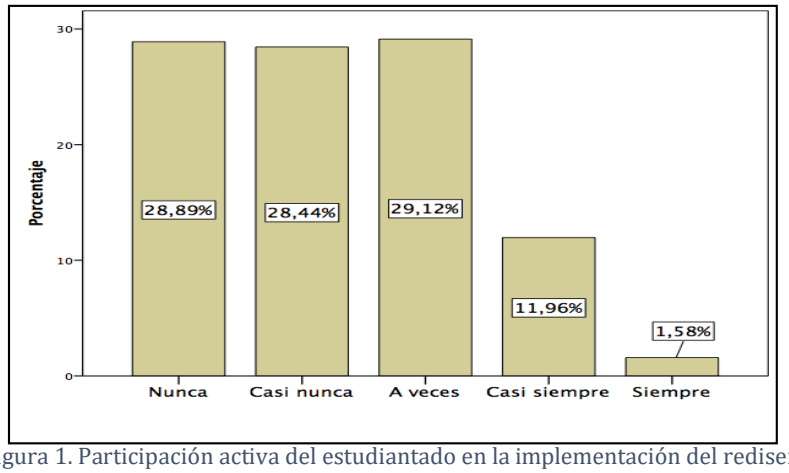

Figura 1. Participación activa del estudiantado en la implementación del rediseño

4.2 Teachers in the redesign

4.2.1 Relationship of the redesign subjects with the graduation profile

In relation to the subjects that students study in the redesign of the careers, if considering the alternatives almost always and always sum 47.43% that indicates that these do contribute to the graduation profile. However, 19.68% of students indicate never or almost never, because for this group the analysis units do not respond to the graduation profile of the careers (Figure 2).

From the beginning of the academic program implementation as expressed by teachers in the focus group:

> A number of inconsistencies and weaknesses in the curriculum were observed, both in training fields, in the logical sequence of the subjects and in the time load. It was even said that in some cases, the curriculums do not respond to the career's graduation profile (Grupo focal, docentes, enero de 2019).

> However, it was also said that the redesign does respond to the graduation profile; however, many subjects are new, with novel content but there are no specialists in these subjects. There are some materials that are incompatible with what is required; there is duplication of content; too many general subjects and few in the specific fields of the careers; in some cases, pre-professional practice has been given greater importance without an adequate conceptualization and understanding of changes in redesigns, e.g. Integrative subject, PIS, PAE (Grupo focal, docentes, enero de 2019).

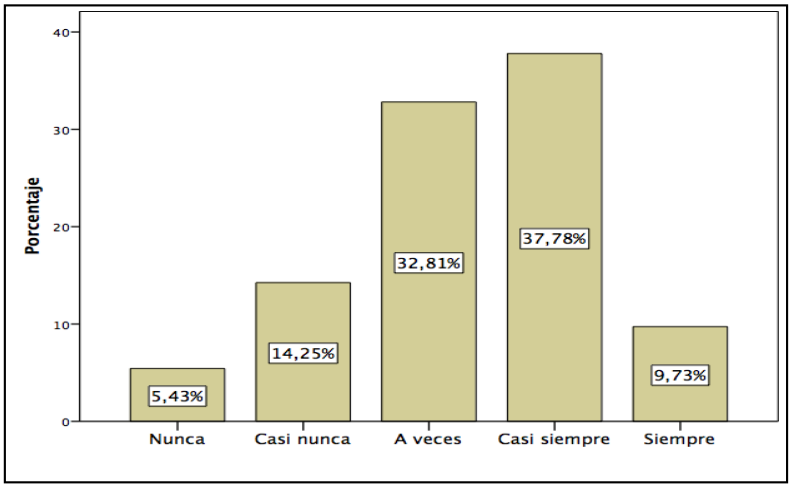

Figure 2. The subjects that the students receive are related to the graduation profile of the careers

4.2.2 Career specialization subjects in the academic program redesign

In Figure 3, the alternatives almost always and always represent 45% of the responses of students that indicate that the subjects of the curriculum redesign do respond to the specialization of the careers. However, 21% of students point out that never and almost never these subjects respond to the specialization, perhaps it should be asked about this, whether the redesigns actually considered the relevance to their elaboration.

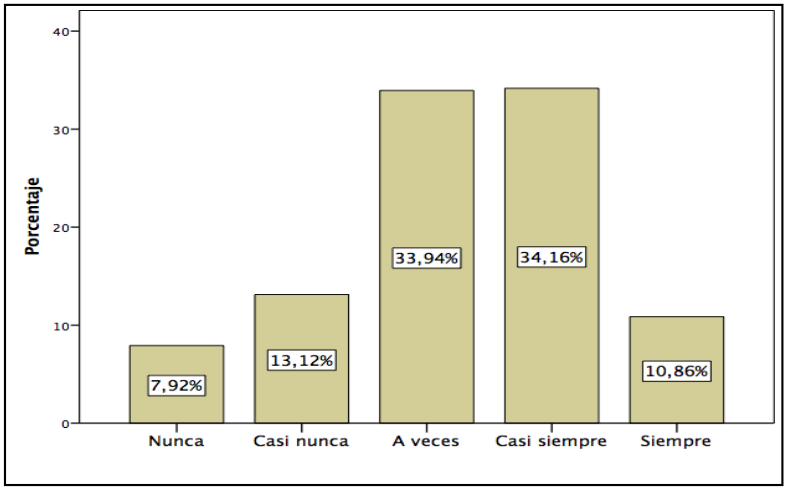

Figure 3. Curriculum redesign subjects respond to career specialization

The perception of teaching is that the subjects respond to the specific field of the profession. However, it was said that in some careers the specialty starts only in the fifth semester, or that the time load is lower for subjects in the specialty's own field, which does not allow to deepen its contents.

On the other hand, it is found that the distribution of the time load, both for teacher training and for the specialty, does not satisfy the majority of students and teachers of different careers. Generally, an insufficient number of hours is set for specialty subjects. This situation limits the in-depth approach of the contents of the different subjects.

4.2.3 Time load for teacher training

If considering Figure 4, the trend is almost equal in the first three alternatives for the time load assigned to the subjects of teacher training, i.e., there are students who say that the time load is insufficient compared to others. This takes to the common point that the Faculty must agree on to harmonize subjects, contents and time load for this field of teacher training.

This agrees to the information presented in the focus group with teachers, "pedagogy and didactics do not have sufficient teaching hours to deepen the development of the contents" (Grupo focal, docentes, enero de 2019).

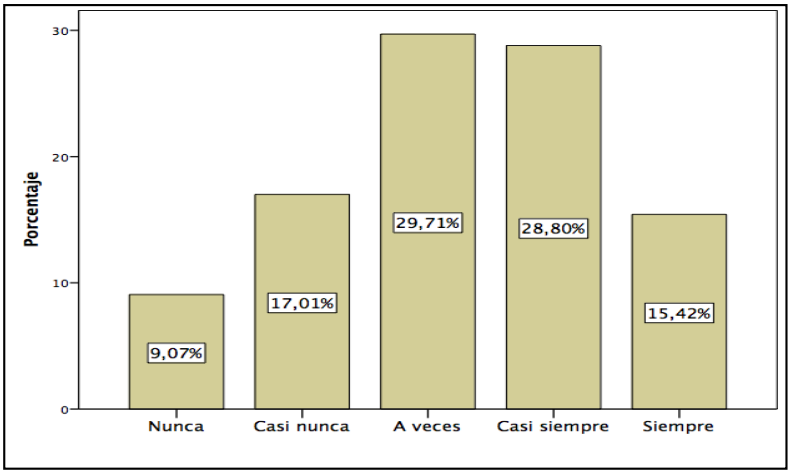

Figure 4. Time load distribution for the teacher trainin

In addition, the use of traditional methodologies in the teaching and learning process was found to persist. With the implementation of the redesigns, the classroom work has not been innovated and therefore pedagogical renewal in methods and methodologies is insufficient. The focus group reflected on this problem, since, in principle, a redesign changes methodologies, methods, contents, structures, but in this case, no significant changes are observed.

Facing the alternative if the subjects respond to relevance, the answers are very similar to the previous ones; it seems that redesigns respond weakly to specialization and teacher training. The explanation may be, according to what was expressed in the focus group, in the existence of general subjects with contents that do not contribute to the two main training fields, namely: specialization and pre-professional practice.

4.2.4 Application and experimentation practices (PAE) in the teaching-learning process

The Faculty's Innovation Committee notes that "PAE is the time that prioritizes the application of knowledge" (Comisión de Innovación, 2019, p.3). In other words, PAE hours are assumed as an academic process of linking scientific theory with socio-educational practice.

Under this consideration, students were asked whether PAE contribute to the teaching and learning process; negative responses represent a little more than half of the answers, as shown in Figure 5.

Unlike these student appreciations, professors see it as a positive aspect to strengthen and feedback knowledge. How it is implemented depends on the initiative and understanding they have about PAE in each career.

> PAE hours have forced us, in some cases, to think about how to organize ourselves in a more appropriate way in the application of theory to reality; also, in other cases it has made it possible for us to break with traditional pedagogical models that prevented meaningful learning (Grupo focal, docentes, enero de 2019).

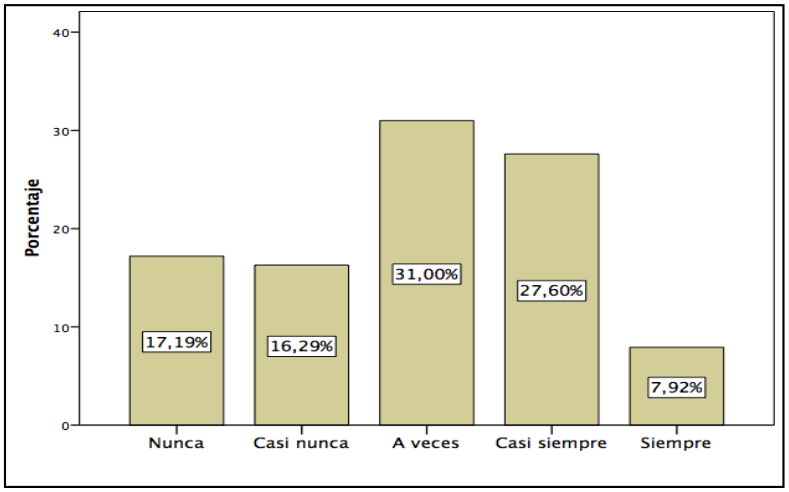

Figure 5. PAE hours contribute to the teaching-learning process

4.3 Research on the redesign

Figure 6 shows a positive trend in assessing research capacity development with the implementation of the redesign (46.15%) compared to a negative 19%; however, there is 34.84% who doubt on the contribution of the redesign to the development of investigative capabilities. This result challenges the process being implemented, in the sense if students are actually apprehending the theory and methodology of scientific research. One wonders whether students feel part of the research process, whether they have clarity on what they are going to investigate, why and what for.

Based on the perception of teachers who participated in the focus group, curriculum redesign does contribute to research training. It was further stated that if there was an initial effort to produce and develop the research tools, the instruments already developed in previous projects were being used in the following semesters. This causes the investigative process to be instrumented, making students "operators" of research, not active subjects prepared to build proposals for changing and transforming the education system.

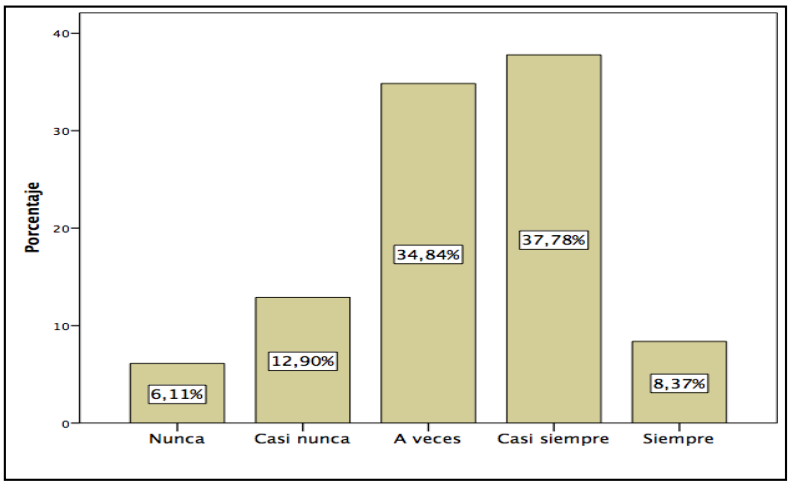

Figure 6. The implementation of the redesign strengthens the development of research capabilities

Undoubtedly, research is the primary action in higher education, as established by the World Conference on Higher Education"no other time in history has been more important than investment in higher education, because of its status of primary force for the construction of knowledge societies... and to encourage research and innovation" (UNESCO 2009, p. 2).

In the focus group, teaching also expressed that the challenge of academia is to find strategies that allow the impetus of formative research in all subjects. For example, it was emphasized in the development of research and reading capacity in the students that allow them an adequate investigation and interpretation of phenomena in the socio-educational context.

4.3.1 Integrator Knowledge Project – PIS in the vocational teacher training

PIS, as conceived by the CES, responds to the problems from an interdisciplinary and multidisciplinary approach that need the input of the different training fields of the curriculum redesign. It should be noted that each PIS responds to a systematic logic that starts from the most general fact of the research of the educational contexts and their environment up to the specificity of each career.

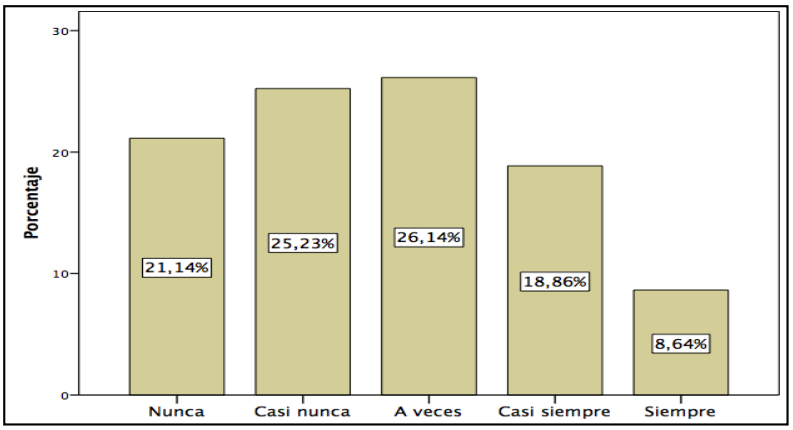

Figure 7. PIS contributes significantly to the professional training of students

On PIS contribution to vocational training, the perceptions of the student are mostly negative, as shown in Figure 7. This assessment is explained by the practice of no adequate treatment of PIS as an innovative methodological strategy. There is a misguided vision of looking at PIS in an isolated and fragmented manner, unrelated to its next or previous PIS, thus limiting the articulation between semesters and interdisciplinarity. In short, there is no adequate understanding of the teaching or students of the epistemological, psycho-pedagogical and didactic conception that will guide the implementation of PIS.

> These responses are corroborated by teachers who describe that the way the PIS is implemented does not achieve a significant contribution to the vocational training of the future teacher. There are aspects that do not contribute to the purposes of PIS, such as misunderstanding of the scope and objectives of the PIS. In addition, there is an overload of activities inherent in the development of PIS. It is also necessary to design appropriate and consensus strategies and methodologies to plan, implement and evaluate the PIS (Grupo focal, docentes, enero 2019).

In other words, "The development of PIS is not significant research, instead, it relies on repetitive theoretical information, but as a research contribution it is limited". In addition, it was said that it should be asked: "whether the periodicity of the PIS is adequate or time-extending is required" (Grupo focal, docentes, enero 2019).

It should also be noted that "educational institutions do not find in PIS any contribution, it is seen as a distracting factor but the school´s authorities must authorize their realization due to the provision of the Ministry" (Grupo focal, docentes, enero de 2019). In addition, it was suggested that from the experience of the PIS implementation of the previous four semesters, a reform be carried out so the PIS in the first semesters is a theoretical and methodological training. While the application in the socio-educational reality context starts from the third or fourth semester.

Other proposals were: a) Reorienting the concept of PIS as an articulating axis of inter- and multidisciplinary work; b) Problems should be formulated according to the contextual and complex realities of educational environments; c) Other spaces must be opened so that it is not only in the educational institutions in which this activity is carried out but depending on the specialty it can be incorporated into other institutions and organizations that are linked to society; and, d). It is necessary to monitor the PIS to understand its complexities and dynamics (Grupo focal, docentes, enero de 2019).

They also believed that the contents of the subjects did not contribute to the realization of the PIS. There is poor articulation and little contribution of the subjects, as there is still a departmentalized management of each of the subjects, away from a comprehensive vision of the curriculum. Interdisciplinary work on the curriculum contents of the subjects is not yet achieved with the application of the redesigns.

4.4 Pre-profesional practice in the redesign

The function of pre-professional practice is the application of knowledge in the specific specialization field to strengthen skills in professional practice in the educational field. In relation to this, the perception of students is significant (55.05%), because they show that the practice that develops in the curriculum redesign strengthens the teaching vocational training in the development of their capacities (Figure 8).

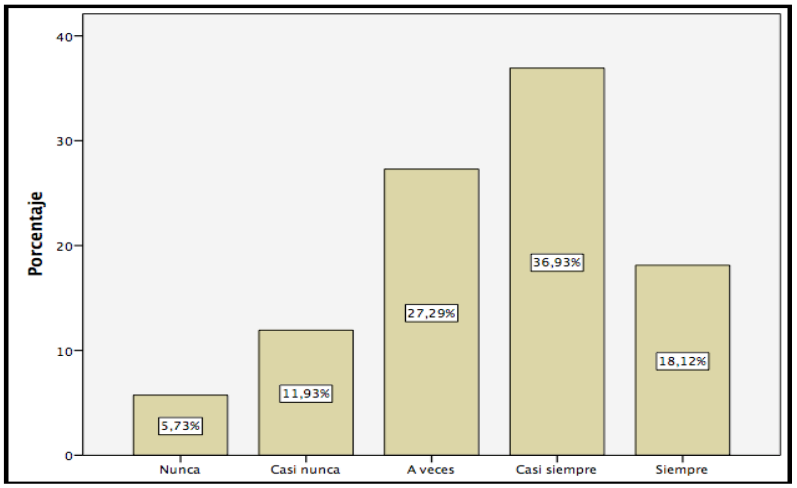

Figure 8. The pre-professional teaching practice in the curriculum redesign strengthens the teacher training

These assessments are also positively valued by the teachers that participated in the focus group. It is worth noting that the contribution perception of the pre-professional practice by the students is still limited since they have not yet performed this activity by reaching the fourth semester. Pre-professional practice develops more forcefully at higher levels of career training; however, in the first semesters, they have an initial approach through observation practices allowing them a better understanding of the educational reality.

4.5 Reform of the academic program redesign of the careers

When students were asked if they agree to reform the academic programs of the careers, the answer shows a blunt yes to reform to improve current redesigns. These responses reaffirm perceptions that redesigns do not respond significantly to the career graduation profile, as there was no prior understanding and training of the educational community.

In short, the educational community of the Faculty of Philosophy, Letters and Educational Science shares the initiative to make improvements to academic program redesigns in such a way that they respond strongly to professional profiles of the careers. As well as the relevance of future education professionals with the needs and requirements of the education system in the different areas of knowledge.

4.6 Main difficulties in the implementation of the career redesigns

- The focus group with teachers noted that the redesigns were imposed by the CES to respond to government policy on higher education. It was stated that they were even forced "to assume by the name of the careers, the curriculum, the time load, the problem, and even the same curricular contents" (Grupo focal, docentes, enero de 2019). These answers explain the inconsistencies found at the time of the implementation of the redesigns in the careers.
- It is worth mentioning that although the redesigns were created taking into account the traits of each career, there are cases that show substantial weaknesses in the fields of vocational teacher training and especially in the specific field of the profession. The subjects taught with the curricular redesigns are not relevant to the specialty of the career and the time load does not respond to the reality of the learning process (Grupo focal, docentes, enero de 2019).
- Research is still very limited and anarchic, with the implementation of the redesigns it would seem that there is no correspondence between research theory and

practice. Also, careers show serious difficulties at the time of the organization and implementation of the PIS.

- There is a segmented view of educational work, subjects very often set boundaries between one subject and another. An individualized work of teaching persists, which prevents the development of an inter and multidisciplinary work necessary for the realization of socio-educational studies that respond to the needs and demands of citizens.

4.7 Guidelines for improving academic program redesigns

According to the responses issued by students and teachers, the following suggestions are found to improve academic program redesigns.

- Review the curriculum and time load in the fields of theoretical training and professional practice to respond to the graduation profile of the career.
- Strengthen the academic and administrative organization to improve the implementation of academic program redesigns in the careers
- Establish conceptual and methodological strategies for the implementation of PIS and PAE in careers.
- Define an administrative academic management system that optimizes the management of pre-professional practice throughout the Faculty.
- Promote interaction spaces with the participation of students, teachers, and authorities for the promotion of thoughtful and critical thinking in the implementation of the redesigns.
- Organize permanent teaching update processes to respond to the new vocational training challenges covered by curriculum redesigns.
- Strengthen scientific research processes that respond to the socio-educational problems of the country that consider the strategic lines of the Faculty.

5. Conclusions

The results of the study of the redesigns that began in the academic period 2017–2017, which is in the fourth semester of implementation, allow the following to be concluded:

Academic program redesigns need to be rethought with a comprehensive vision in order to respond to the guiding principles of the Faculty. The needs and demands of training of teaching professionals in the country must be considered to demonstrate their relevance. As Larrea (2015) points out "There is no clear diagnosis of the needs of actors and productive, political, social, environmental and cultural sectors for the organization of pre-professional practices, therefore, the efforts that are made are not observed" (p. 11).

Poor participation of the educational community in the elaboration and implementation of academic program redesigns of the careers. This situation is probably due it was imposed by the CES, therefore, it was neither a necessity nor a demand from the University. For this reason, the result of this is that there is no appropriation of it by the teachers and the students. In this sense, Durán (2016) states that emancipatory education "is a participatory process of social construction that breaks with those oppressive situations and colonization that prohibit being, saying and doing..." (p. 38).

The curriculum of the careers mostly do not respond to the graduation profile, the subjects do not reinforce the specific field of the specialty or teacher training. This situation is explained because CES designed a generic curriculum model with which guided redesigns

in education careers. However, it is necessary to review and make the adjustments that are relevant, so that they respond to the professional profile of the careers.

The PIS has not found an adequate way to be applied in the reality of the educational context. Although SENESCYT (2013) states that "PIS is the first educational experience that enables the student with the learning research process..." (p.18). A weak conceptual and methodological understanding of the purpose of teaching's development of integrative knowledge projects still persists. The absence of a conductive line and the lack of teaching experience in carrying out this activity has made it a useless and unvalued work overload. In addition, the segmented and individualized teaching work that prevents collaborative and interdisciplinary work in the development of PIS.

PAE hours, as we know, are part of the activities carried out in the classroom to fix knowledge in practice; it is the theoretical scientific application in social practice. This fact agrees with Carrión et al. (2018) "Practice as the starting point of knowledge, as a means of testing theory and as a tool... to solve problems" (p. 27). The application of PAE creates confusion because it is believed to be an extracurricular activity, apart from the teaching and learning process. It is vital to establish the relevant pedagogical guidelines for their proper implementation in the different subjects since this is an aspect that is positively valued by students and teachers in vocational training.

In the work of the academy, research is one of the most important functions that must be present throughout the educational process. The incorrect practices that are happening in universities must be overcome, where investigation only occurs by obligation. In this perspective, Barreno et al. (2019) state that "The fundamental functions of the university are teaching, research and linkage as a dynamic and integral whole whose ultimate purpose is vocational training, scientific production and contribution to the problem solution of the society" (p. 38). In other words, academic program redesigns should articulate these functions in order to strengthen and enhance research capacities in the teaching profession.

Emphasis has been done in the need for the updating of knowledge to teachers in the use of appropriate methodological strategies, in the deepening of content in the specific field of the specialty, and in totally new subjects that are not part of the expertise fields or the field of professional practice. These are aspects that must be considered from the authorities and teachers in order for the training of the student to be integral and integrative of the implementation process of the academic program redesigns.

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