Information and communications technologies in androgynous learning

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Abstract. The globalization of the economy, information and communications has allowed the social dynamics to be competitive, leading to social transformations, to respond to these demands they require new educational approaches as an alternative in the transformation of environments in line with the globalized world. The information and communication technologies used as an educational resource play an important role, facilitating the interaction, transport and dissemination of knowledge to remote places, where androgynous learning is required, a fundamental option for the formation and training of society, which leads us to reflect about the actions of teaching in adult education. The methodology used was based on the qualitative paradigm supported by phenomenological research methods, hermeneutics and ethnomethodology allowing close relationship with key informants, triangulation was used as a strategy to correct distortions. As results, the theoretical, epistemological foundation framed in significant elements that are derived from ontological, gnoseological, philosophical, pedagogical and andragogical postulates is established, establishing pedagogical conceptualization. In conclusion, it is considered that teaching models constitute the path for the transmission of knowledge, it is there that the technological tools of information and communications become facilitating means in the teacher-student interaction, allowing the efficient development of curricular activities.

1. Introduction
The globalization of information and communications marks the trend and the path to follow in modern education, hence one of the myths that have most enthused the world of education at the beginning of the twenty-first century has been to build a kind of educational engineering. That is to say, an engineering understood as a set of knowledge and procedures of action, that allows to dominate the variables of the teaching process to be able to manipulate them with precision and in this way, to achieve true educational revolutions, as Brunner puts it these changes of paradigm "have always been product of a particular constellation of changes in the environment in which education operates. They are processes that, contrary to what the more immediate interpretation of the term revolution suggests, take a long time to occur" [1].

In this sense, continuous training in education is one of the pillars on which the information society is based. In this era of change, social and cultural transformations are questioning educational approaches, while at the same time the demand is for education to be a leading alternative in the transformation of the social environment in accordance with the demands of the globalized world. However, as is the case in all social transformations, education has embarked on the search for new alternatives that allow it to adjust to the avant-garde demands and social needs of information and
communications. Information and communication technologies (ICT) are showing up as a fundamental and relevant educational resource in social transformations, as stated by Daniel quoted in Indah and Sukarata "Distance learning is an educational process that involves technology that is free from distance constraints, places, and even time-free synchronization" [2].

It is clear, then, that research, innovation, advances and new technologies generate constant changes and learning needs, since society itself makes demands for training that involve teaching models. Indeed, information and communication technologies offer a series of possibilities for specific training depending on the group to be trained and the content to be taught. They are a means of implementing new pedagogical models that increasingly require safer means of transporting information and, therefore, of promoting significant changes in society. Consequently, environments have been created for education that allow it to interact, exchange and disseminate knowledge to the most distant places of civilization. In this regard, Delors evidences that from childhood it is necessary "not only to learn, but also to use a type of reasoning as a hypothetical-deductive "investigation" that allows each and every one of the citizens to be better prepared to face the events that will take place. Currently, information technology can help teachers in this fundamental pedagogical trend" [3].

With reference to the foregoing, ICT online education is characterized, in principle, by expanding access to education, promoting collaborative learning and group work, initiating active learning, creating student-centered learning communities to make the traditional roles of the teaching-learning process more fluid, since any information generated on the Internet has the possibility of being stored and accessed. The impact of ICT, specifically "e-learning systems will become more attractive as they will encapsulate up to date information addressed to every type of student in particular dependent on its profile and its interface and presentation form will be more intuitive and adjustable to any screen or OS environment" [4], thereby bringing about far-reaching changes in the field of education.

On the other hand, the new learning theories that focus their attention on both the teacher and the learner in the process of learning that generates added value in the student, have a strategic ally in these technologies, used these in the light of the postulates of constructive social learning, under the principles of significant learning. In this regard, Brunner states that "... for innovation to exist, these technologies must be used in situations where they produce "added value", novelty, unexpected results, alterations of what exists, what is known, what is habitual" [1].

According to the reasoning that has been carried out, these new technologies propose paradigms that have been revolutionizing social contexts, affecting the design and application of public policies tending to the transformation and insertion of higher education in the dynamics of the globalization of information and knowledge, generating in the university the need to know the social contexts, as a fundamental input in the updating and adjustment of the curriculum in such a way that its final product (graduate) responds to the demands and needs of the globalized world.

On the other hand, in reference to andragogical learning it can be said that this leads to purposes of great value for the education and training of society in general, since they lead to rethinking the action of teaching and training; in this sense, it is necessary to bear in mind the process of adult thought and work experience, the andragogical act is proposed as an educational option to be implemented in higher education or in its absence in any social context. A study by Sayidiman, Kismanto and Sahriyanti points out that "The results showed that the model of learning andragogy based on community learning with expert validation test, the model is quite valid and feasible to use" [5]. And from this approach, but in a regional context, Felix Adam, quoted in Alonso, maintains that "Latin American university teaching must be renewed; that is, abandoning pedagogy and taking advantage of the andragogical act, since the student body is an adult and as such has a defined psychosocial profile and a way of learning in a differentiated context" [6].

In this sense, andragogy is considered as a science and an art where the solid bases of teaching are established and without any doubt the strategies to successfully achieve a link with what distance education establishes; in the same way, the parameters that virtual education currently brings with it, has the advantage of offering new opportunities, forms and ways of being educated, depending on the progress and development of the country. It is clearly observed that the transformations generated by
information and communication technologies and their impact on andragogy induce universities to rethink and reflect on the multiple events that education must face in all systems and in all their scenarios; hence, the intention of this research which falls on: to generate a theoretical-epistemological construction (pedagogical model) for the distance education modality of the computer science degree program of the “Universidad Francisco de Paula Santander (UFPS), Colombia”, from the perspective of information and communication technologies and the andragogical learning factor.

From the previous approaches, it can be deduced without any doubt that this theoretical construction will generate important and significant changes in the new teaching styles, models and challenges that today's society insistently demands. This situation is not alien to the UFPS that currently seeks to prepare for futuristic scenarios where educational models are implemented strengthened technological processes changing the dynamics of teaching in the mode of distance education that increasingly becomes important and accepted, thanks to the urgent need to qualify the capabilities of people who somehow want to be protagonists of their own development and are difficult for multiple reasons to attend a classroom, hence the interest to ask: How can one contribute to the implementation of the distance education modality of the degree in computer science at the UFPS?

In order to answer this question, the research was based on the precepts of the qualitative paradigm, as well as on phenomenological and hermeneutic methods, complemented by ethnomethodology, used specifically for the collection of information; it is important to point out that what the research seeks is to structure the theoretical foundations that frame the route to follow of the computer science degree program for the distance modality at UFPS, prioritizing information and communication technologies in andragogic learning, as holistic elements that constitute the basis for quality education.

2. Methodology
The present study was based on the qualitative paradigm considered "as a way to understand in depth the meanings that allow us to define the situation as it is presented by the research subjects" [7]. However, since the intention of the researcher is not only to know the reality based on the information obtained and his own observations, but also to propose solutions based on the potentialities of the field of study and the needs of his informants, it is therefore necessary to decide on a type of qualitative research that allows the subjects researched to participate in all phases of the process.

Therefore, the research was developed taking into account the theoretical postulates of research methods such as phenomenology and hermeneutics, supported by the complementary method ethnomethodology used for the collection, analysis and interpretation of information; Likewise, for the investigation the UFPS was defined as a scenario, specifically computer science degree program, distance modality, taking into account that the ideal scenario for the qualitative investigation is the one where it is possible to establish a close relationship with the informants and that they are the living and documentary sources, its selection was made in function of having elements for the triangulation and that served in the saturation of the information. It will be understood that this "sample of informants represents in the best possible way the groups, orientations or positions of the studied population, as a strategy to correct perceptive distortions and prejudices and because every human reality is polyhedral, has many faces" [8]. Therefore, key informants were considered to be persons belonging to the computer science degree program distance education modality of the UFPS.

It is pertinent to point out that the key informants according to the group they belong to were coded: students (EST-01...), teachers (DOC-01...) and graduates (EGR-01...), with the intention of leaving evidence of the testimonies of each one of the information found. It is worth mentioning that coding is also used for the construction of the information base and semantic networks that are derived from the application of the Atlas Ti software; this at the same time allows the intentionality of response to be established, facilitating its theoretical construction. The analysis process, according to Buendía, et al. [9], comprises three fundamental steps: reduction of the information, elaboration of the information and obtaining the conclusions within an interpretative process; next, the techniques and instruments refer to the means and procedures used by the investigator to obtain the information.
The data was achieved through direct observation and in-depth interviews that were first recorded, trying not to interrupt the conversation and respecting the information provided by the informants. This technique is defined by Hurtado as "...an activity through which two people (sometimes there may be more) stand face to face, for one to ask questions (obtain information) and the other to answer (provide information)" [10].

Finally, the analysis of the information obtained in the implementation of each of the instruments (script of questions, anecdotal record) appropriate to the qualitative research was carried out for the comparison and study of each one of the obtained contents, to arrive at the categorization (modality of distance education), pedagogical teaching model, information and communication technologies in distance education, andragogical learning in distance education, socio-labor impact of information and communication technologies and andragogical learning in distance education). Subsequently, the information was organized in order to compare the information against the instruments and information obtained in order to extract the most accurate and objective data from the research carried out, giving credibility, audibility and transferability to the work carried out, which for Parra triangular means "...to compare and verify the consistency of the information derived from the same source, but in varying times through different qualitative methods" [11].

3. Results discussion
With respect to the information collected, it is important to point out that by taking the broad categories set by the researcher to give epistemic orientation to the research, subcategories emerged from the instruments applied (in-depth interview script) that allow us to glimpse the structure of the results found, which emerged from the in-depth interviews conducted with key informants, which in this case consisted of eleven people structured as follows; five students (EST-01...), three lecturers (DOC-01...) and three graduates (EGR-01...). Likewise, it is worth mentioning that the treatment of the information was framed in the application of Atlas Ti 7.0 and in the process of contrasting the information and from where the subcategories with their respective dimensions of analysis are derived.

- Distance education modality category: In Colombia, despite the difficulties of implementing high quality education in the distance education modality, there is a great boom in higher education programs that make institutional efforts to promote education and training in accordance with the levels and demands of today's society [12]. There is no doubt that "ICTs have always been beneficial to all aspects of human engagement. Academics is as one of the major beneficiaries with ICT being integrated ICT especially in open and distance [13] and where knowledge and information constitute a fundamental asset of intellectual capital" [14].
- Category pedagogical teaching model: The pedagogical model of teaching varies according to the institution where it is used; such is the case that within the UFPS of San José de Cúcuta, Colombia, a dialogical approach is administered - critical within what is the degree in computer science; under the modality of distance education, it is important to point out that the investigation was centered in this faculty by the intentionality of the same one that manages to include what is the information and communication technologies and the andragogical learning understanding that this come to transform the pedagogical model and to implement strategies that converge in the demands that society poses to the institutions of higher education.
- Category ICT in distance education: Information and communication technologies are currently becoming a support for teachers and students; information and communication technologies are the main lever of unprecedented transformations in the contemporary world. In fact, no other technology has brought about such major changes in society, culture and the economy. Humanity has significantly altered the ways of communicating, entertaining, working, negotiating, governing and socializing, based on the diffusion and use of information and communication technologies on a global scale.
- Category andragogical learning in distance education: Andragogical learning is conceived as learning that originates from the cradle to the grave; however it has been accentuated in adults
and more in those who are formed and trained in an autonomous manner; which indicates that within distance education andragogical learning falls directly and for that reason the teacher has an ally so that it is the will, the interest and the commitment that plays a role of great significance of there the intention to involve this factor of learning to make the process of teaching and learning more effective.

- Category socio-labor impact of ICT and andragogical learning in distance education: As for the social-labor category, it was possible to investigate through an in-depth interview that the field of work is broad in society, and even more so when it comes to the applicability of ICTs in the social context. It can be pointed out that graduates in computer science have a radius of work action that guarantees them sufficient work, and an element arises there to consider what quality is like; that is, productivity, performance and quality are pointed out, which converge in the progress and development of society, which currently demands transcendental changes and transformations.

### 3.1. Theoretical construction

One of the most complex systems in which they often appear is in higher education. For this reason, it is necessary to base their mission and see their correlation with the andragogical factor that has as its aim to nourish the possibilities that adult education has in this case under the distance education modality. Now, the theoretical-epistemological foundation, which contains significant aspects of what are the foundations that define distance education in the computer science degree program, framed in elements that are derived from the ontological, gnoseological, philosophical, pedagogical and andragogical postulates, all of which come together to define the operativity of the same in the application of the foundations, understanding that these are framed in two elements of extreme care in their applicability, such as the transversal axes and the complementary phases, making it clear that the first is in charge of establishing a pedagogical conceptualization and the second fulfills the function of reinforcing and solidifying knowledge; This contributes to the formation and training of a professional with very broad occupational characteristics that reflect his actions in the productivity and quality of the processes. In this case, it is linked to distance education, bearing in mind that society, national and institutional systems of higher education tend to conjugate a hybrid model that incorporates face-to-face and distance modalities, in a differential degree and according to key factors of technology as well as management capacity and strategic alliances.

#### 3.1.1. Pedagogical fundamentals

Educational praxis is the fulfillment of educational activities through different types of acts, such as pedagogical acts, formative research or research in general, extension, administrative acts and social work acts. Thus, praxis allows the creation of conditions according to the needs of people, for human development or so that relationships can be reaffirmed, on that which is composed of the field of knowledge, both theoretical and experiential, based on the actions of educators with students, principals with support personnel, principals and teachers with parents and from parents with children [16].

#### 3.1.2. Operativity of the theoretical-epistemological foundation

Education is considered as a global process, aimed at generating behavioral changes and significant transformations that encompass the extension of human life, which aspires to form man from a very early age through his whole existence, attending to the stages of his evolutionary development, taking into consideration his nature, motivations and interests. It is not the same to educate a child or adolescent than an adult, interests, intellectual development and experiences establish marked differences that merit adequate educational treatment, for this reason, education must be methodological, appropriate to the educational level and modality, where its objectives aim at the integral development of the individual and the formation of a man capable of involving himself actively and consciously in the search for solutions to the problems of the community, institutions and education in general.
According to the above, for the operation of the theoretical-epistemological foundation, some foundations defined as transversal axes are proposed, which are supported by the principles of complementarity, thus generating a structure based on the search for quality, efficiency and effectiveness. Among the transversal axes that are foreseen according to the author [15] are the following: Pedagogical research seminar, transdisciplinarity and complexity, self-learning and motivation, ICT in labor action.

- **Pedagogical research seminar:** The pedagogical research seminar is fundamental in the development of the career and should therefore be involved in all courses because it is necessary to provide tools for the participant to acquire and give solidity to their knowledge; through practical research reason for which the teacher should prepare and this at the same time extrapolate their knowledge to the participants of the courses to obtain the knowledge and skills to build and carry out a research project, it is recommended that from the beginning of the career begin to give the guidelines for a research and according to the progress of the semesters can go refining the same from the theoretical construction to consolidate the methodology to follow; Therefore it is essential to appoint a research committee to take control of the research work and to clarify doubts so that participants can obtain the tools to do research on the different topics assigned to them as well as when they wish to investigate by their own means.

- **Transdisciplinarity and complexity:** In this case, transdisciplinarity and complexity are proposed as a transversal axis with the intention of being able to correlate contents in the first place and disciplines in the second place in order to generate new knowledge. To this end, it is necessary to provide teachers with proactive and creative tools to generate new knowledge and at the same time give new contributions, contributing from exchanges and socializations to establish innovations that allow participants who are under the distance education modality to easily obtain the knowledge and extrapolate it to their workplaces with responsibility, commitment and quality; In order to establish this axis, it is necessary to prepare teachers so that they have in their hands the lines of action of how to make the process of transdisciplinarity, which is nothing more than transcending knowledge from different disciplines in order to conjugate objectives and correlate contents in order to visualize new learning.

- **Self-learning and motivation:** Another of the transversal axes is framed in the self-learning and motivation and then it is required that in the classes or meetings that are carried out to socialize the self-learning is promoted and for that creative pedagogical strategies are proposed as the use of the optical illusions, the music therapy, stimulation of creative thinking among others in order to promote motivation under the precepts of motivation to achievement and strategic learning and for this it is necessary to prepare teachers first and secondly to set events or alternatively meetings or conversations for the exchange of ideas on the subject and it is worth implementing in this aspect the conversations that are popularly called “chertulias”, evening conversations among others; It is important to implement the use of social networks for forums, video conferences among others with the intention of maintaining constant communication between teacher and participant, which internally leads to a relationship that nurtures the education and training of future computer science graduates.

- **ICT in labor action:** It is essential that all courses promote the use of the technology platform "PLataforma de Apoyo a la Docencia (PLAD)", which is a tool for both the tutor and the participant to exchange information and this leads to the knowledge that can be used in the workplace; and such ensure successful use of the technology platform through the virtual classroom. It is also recommended that the program create an app so that participants can have it on their Smartphones and learn about the assignments and/or commitments on a particular topic, almost in real time, that would have a more frequent contact with students and more solid which leads to participants to be in constant exchange also through technology, it is important to create WhatsApp groups and by some application that allows to upload video-conferences, this dynamizes the constant exchange of information. As in all the transversal axes, the tutors
must be trained and promote in them the adequate use of technological means for the exchange of knowledge and information.

4. Conclusions
The teaching models constitute the way for the transmission of knowledge, it is there where the technological tools of information and communications become means through which they facilitate the teacher-student interaction, allowing in this way the efficient development of the academic activities established in the curriculum and oriented in its mission. This action, in addition to improving and broadening access to information, has the goodness of having social reaches that do not distinguish distances, age, social condition; characteristics that strengthen andragogic learning. The theoretical epistemological foundations constitute the basis of the theoretical approach and become elements that, if applied, will allow total success in the education and training of computer science graduates, who seek to prepare for various fields of work, demonstrating quality in productivity and good professional performance, in accordance with the demands of today’s society, which at no time goes alone but is always next to information and communication technologies generating changes and transformations so that at all times lead to a more effective distance education in the training of graduates.

The operativity of the theoretical foundation is proposed in two phases, the first framed in transversal axes that focus their interest in the training and constant training of computer science graduates and the second phase focused on the principles of complementarity that are currently fundamental to provide training and training according to the demands of future graduates; However, in order to implement the theoretical foundations defined as transversal axes, an important and significant contribution was being made to the graduate program under the distance education modality, from there a rethink and a new action arose to improve and update the program to the demands of the globalized world.

References
[1] J Brunner 2000 Educación. Escenarios del Futuro. Nuevas Tecnologías y Sociedad de la Información (Bogota: PREAL)
[2] Indah K A T and G Sukarata G 2018 Journal of Physics: Conference Series 953(012052) 1
[3] Delors J 1996 La Educación Encierra un Tesoro (Paris: Santillana, Ediciones Unesco)
[4] Musca G, Mihalache A and Muscas E 2016 IOP Conference Series: Materials Science and Engineering 161(012019) 1
[5] Sayidiman, Krismanto W and Sahriyanti A 2018 Journal of Physics: Conference Series 1028(012085) 1
[6] Alonso P 2012 Revista Electrónica Educare 16(1) 15
[7] Enciso C 2016 Bases teórico - epistemológicas para un modelo de evaluación curricular por competencias en los programas de fisioterapia en Colombia (Rubio: Universidad Pedagógica Experimental Libertador)
[8] Martinez M 2004 Ciencia y Arte en la Metodología Cualitativa (México: Trillas)
[9] Buendía L, Colás M and Fernández F 1998 Métodos de Investigación en Psicopedagogía (España: Mc Graw Hill)
[10] J Hurtado 2000 Metodología de la investigación holística (Caracas: Instituto Universitario de Tecnología Caripito)
[11] J Parra 2008 Guía de Muestreo (Maracaibo: LUZ)
[12] Cantor F 2019 Journal of Physics: Conference Series 1161(012001) 1
[13] Galeon D H, García P G, and dela Cruz J 2019 IOP Conference Series: Materials Science and Engineering 482(012012) 1
[14] Martínez C 2008 La educación a distancia: Sus características y la necesidad en la educación actual Educación XVII(33) 7
[15] Cárdenas F M 2018 Las TIC como factor de aprendizaje andragógico y fundamento para la construcción teórica de la modalidad de educación a distancia de la licenciatura en informática de la UFPS (Rubio: Universidad Pedagógica Experimental Libertador)
[16] Romero H, Tobos M, Jinete M, and Lindo M 2006 Revista Iberoamericana de Educación 40(5) 1