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To disseminate multidisciplinary scientific unpublished articles, elaborated under the parameters of the research methodology, written with academic rigor and based on the teaching practice.

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

TARGET
The Revista Cétedra is directed to all the national and international researchers interested in publishing quality works that contribute to the improvement of the educational process.

From its origins, the Revista Céetdra was published in printed format. It is currently published in electronic format, using virtual environments to align to the needs of the revista s users and editors.

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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.

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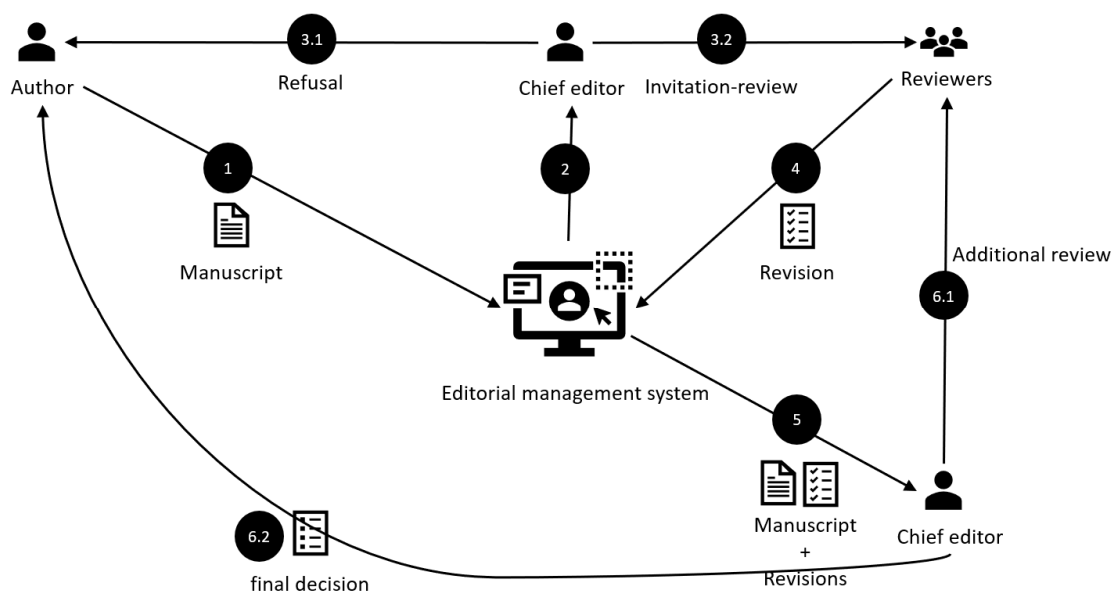
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EDITORIAL

The Cátedra Journal is pleased to present volume 5, number 1 in the electronic version. The contents of this special edition bring together research papers presented at the First International Congress for the Improvement of the Educational System (CIPSE). On this occasion, the central theme was "the challenges of virtual education in the context of the pandemic and post-pandemic" organized by the Experimental Sciences of Computer Pedagogy of the Faculty of Philosophy, Letters and Education Sciences of the Central University of Ecuador.

The academic meeting held on November 15, 16 and 17, 2021 had the participation of 18 international and national lecturers. The thematic areas of research were: inclusion in virtual education, virtual teaching-learning methodologies and the incorporation of information technology in curricula. The papers were presented online and were presented through oral presentation, publication or both alternatives. Each research work, from its perspective, managed to incorporate the need to include in the teaching practice processes of inclusion in virtual education, virtual educational tools to improve the teaching-learning process and digital entrepreneurship processes according to the needs of the educational community.

The current issue consists of nine approved articles:

The first article entitled *Teaching-learning methodologies in virtual education*, authored by José Daniel Espinosa-Rodríguez. The manuscript arises from the need for a continuous and diverse process that requires knowledge and competencies to face life and the challenges of the 21st century, which have become more acute due to the health emergency caused by covid-19. In this sense, the implementation of active methodologies in virtual learning environments, problem-based learning, project-based learning and the inverted classroom are a response to overcome the challenges presented in terms of the development of significant learning in non-face-to-face modalities and the innovation of pedagogical practice mediated by learning and knowledge technologies.

The second article entitled *Educaplay: a gamification tool for academic performance in virtual education during the pandemic covid-19*, by Cristina Páez-Quinde, Ruth Infante-Paredes, Mayorie Chimbo-Cáceres and Estefanía Barragán-Mejía. The objective of the manuscript was to analyze the use of Educaplay as a didactic resource within virtual education and how this process improves student performance, taking into consideration the change of model and application of new methodologies within virtual classes. The research showed favorable results in academic performance with the use of gamification resources, since it was demonstrated that they motivate active participation, collaborative work, and that the teacher is the one who generates his own resources, based on the needs of the students.

The third article entitled *ICT in the family context in times of confinement: connectivity and communication experiences of university students*, by Jorge Silva-Castillo, Mirian Peñafiel-Rodríguez and Amparo Cazorla-Basantes. The manuscript arises from the need to give continuity to a face-to-face work interrupted due to covid-19. The use of Information and Communication Technologies has become an essential element, and under this need, social actors with different realities converged, so the present study aimed to reveal which were the forms of access to information and communication by students of the National University of Chimborazo (UNACH) during the year 2020. A quantitative diagnosis was made of the percentage of connectivity, type of service, with a descriptive transectional non-experimental design in reference to access to technological devices that university students have. The results obtained in this research allowed to know that 70% of students of the four faculties that make up the UNACH during the year 2020 made shared use of devices with other family members to run their academic activities and teleworking within the home.

The fourth article, entitled *Quality Assurance Systems: a tool for the continuous improvement of training programs, centers and universities*, was written by Gloria Zaballa-Pérez. The manuscript is based on the analysis of the Quality Assurance System that covers all undergraduate, master's and doctoral degrees, as well as the management of the activities carried out in all the faculties as a whole. The Global Quality Management System is deployed in the Centers, Functional Areas and Services involved in the life of the university community. The system includes the Institutional Accreditation of the Faculties and the Quality Certifications according to the UNE-EN ISO 9001:2015 standard, in the following Functional Areas and Services: New Students, Library, Hall of Residence and Employment Service.

The fifth article entitled *Challenges of virtual education in Latin América*, authored by Pedro Cantú-Martínez. The purpose of the manuscript was to express and exhibit the challenges of virtual education in Latin America as a result of the advances in communication and information technologies that are currently being deployed internationally, and which were also accelerated after the covid-19 pandemic. In Latin America, education was transfigured from institutions to homes, leading to mostly negative rather than positive educational experiences for a large number of students at all school levels. This was due to the great social inequality prevailing in Latin America, creating a new social categorization, such as the inforricos and the infopobres. In other words, between those who can and cannot access virtual education. This showed once again the great social, economic and educational differences that still exist in Latin America. Finally, the author concludes by indicating that unfortunately technology does not contribute to people's literacy, nor to the universal right to education.

The sixth article, entitled *Didactic, technological and communicational considerations for EVEA design*, was written by Jorge Santamaría-Muñoz. The manuscript determines the didactic, pedagogical, technological and learning methodologies aspects that are considered to develop a VLEE in order to guarantee quality learning. In this sense, 8 experts on the subject of EVEA design and

implementation were interviewed and the data obtained were analyzed using ATLAS.TI 8 software, following the emergent conception model. According to the results obtained, we determined that in order to design an EVEA, the instructional model of Analysis, Design, Development, Implementation and Evaluation should be used, and the EVEA resources should be varied to meet the diversity of learning styles. Finally, the author indicates that the development of the contents should be current, the activities should be focused on solving problems of the students' professional context and should encourage autonomous and collaborative learning. In addition, the andragogical foundations of the students should be considered, as well as the use of the hybrid learning approach (b-learning) and the flipped classroom methodology, so that ICTs are used to support the teaching and learning process and class time is taken advantage of.

The seventh article entitled *Establishing the digital accessibility care unit at the Tecnológico Nacional de México / IT Aguascalientes*, authored by Ricardo Mendoza-González, Juan-Miguel Tovar-Luevano, and Rafael Portillo-Rosales. The objective of the manuscript was to present the set of basic services of the Digital Accessibility Attention Unit of the Tecnológico Nacional de México / IT Aguascalientes (TecNM/ITA), as well as its initial integration to the organizational structure of the institution. These actions were carried out within the framework of the project "Technological assistance to accessibility in Virtual Higher Education, EduTech", registration number: 609785-EPP-1-2019-1-ES-EPPKA2-CBHE-JP, co-financed by the ERASMUS+ program of the European Union. In this sense, emphasis was placed on the implementation of the results derived from two deliverables of said project: "1.1 Report on the state of the art of technological accessibility care units applied to Higher Education", and "2.1 Guide for the implementation and management procedures of a technological accessibility care unit applied to Higher Education". The findings and recommendations of these deliverables made it possible to establish the foundations of the first Digital Accessibility Attention Unit in the entire national technological system, which has 254 institutes throughout the country. It is hoped that the content of this article will inspire other Higher Education Institutions (HEI) to create their own Digital Accessibility Attention Units.

The eighth article entitled *Relational analysis of the graduation profile of the unified general baccalaureate and the academic offer of the Pedagogy in Experimental Sciences and Computer Science degree program,* by Gladys Cabascango-Trávez, Omar Pérez-Narváez, Javier Guaña-Moya and Nelson Salgado-Reyes. The manuscript focused on the factors that influence the relationship between the graduation profile of the students of the Unified General Baccalaureate (BGU) for the entrance to the Pedagogy in Experimental Sciences of Computer Science of the Faculty of Philosophy, Letters and Educational Sciences of the Central University of Ecuador. Non-experimental research was carried out, with a field approach, at a descriptive level using quantitative methodology; in addition, a test was conducted, which worked with the students entering the career as essential informants and data was processed using SPSS 23 statistical software. Among the main findings it was evidenced that the students graduated under the BGU program of study evidence certain shortcomings before the demands of the entrance profile required by the

Central University of Ecuador, also that the skills and abilities acquired by BGU students are elementary, and the expectations that students reach the level of excellent achievement is scarce; decreasing the chances of entry into higher education.

The ninth article entitled *Inclusion in times of pandemic: The advantages and difficulties of virtual education for students with functional diversity*, authored by Carmen Ángela López-Álvarez. The manuscript arises from the need to examine the advantages and difficulties of virtual education for both typical (non-disabled) and disabled students in recent months. It also analyzes the impact - favourable or adverse - of virtual education on the inclusion of students with functional diversity. Throughout this article, definitions such as virtual education, impairment, functional diversity, inclusion, reasonable accommodation/modification and universal design are provided. Finally, the author offers recommendations for incorporating universal design into online courses and what the future of education looks like in times of pandemic.

Cátedra Journal thanks all the authors and reviewers of the articles that have made possible the publication of this issue. It extends an invitation to the national and international academic community to submit their research papers related to Educational Sciences in its different specialties and educational levels.

Directors/Editors-in-Chief

Teaching-learning methodologies in virtual education

Metodologías de la enseñanza-aprendizaje en la educación virtual

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Abstract

Learning is a continuous and diverse process that requires knowledge and competencies to face life and the challenges of the 21st century, which became more acute due to the health emergency caused by Covid-19. In this sense, the implementation of active methodologies in virtual learning environments (VLE) are a response to overcome the challenges presented in terms of the development of meaningful learning in non-face-to-face modalities and the innovation of pedagogical practice mediated by CT. Among the most commonly used methodologies in VLE are the case method, problem-based learning, project-based learning and the inverted classroom. In addition, there are techniques that allow "activating" learning moments, encouraging participation, collaborative work and the generation of content by students, thus favoring application over transmission of content. On the other hand, to effectively introduce ICT in the teaching-learning process through active methodologies involves transforming the educational practice from the change of roles (teacher and students) and their relationship with the digital domain, through the development of digital competencies. Finally, there are a large number of digital resources that can be used as part of active methodologies, whose objective will be to overcome the passive role of students and teachers as consumers of information, allowing them to adopt a more active role in the generation of new knowledge from the exchange with other web users.

Keywords

Learning, teaching, active methodologies, LKT, virtual learning environment.

Resumen

El aprendizaje es un proceso continuo y diverso que requiere conocimientos y competencias para afrontar la vida y hacerles frente a los retos del siglo XXI, los cuales se agudizaron debido a la emergencia sanitaria derivada por la Covid-19. En ese sentido, la implementación de metodologías activas en entornos virtuales de aprendizaje (EVA), son una respuesta para superar los retos presentados en cuanto al desarrollo de aprendizajes significativos en modalidades no presenciales y a la innovación de la práctica pedagógica mediadas por las TAC. Entre las metodologías más utilizadas en los EVA se encuentran el método de casos, el aprendizaje basado en problemas, el aprendizaje basado en proyectos y el aula invertida. Adicionalmente, existen técnicas que permiten "activar" momentos de aprendizaje, fomentando la participación, el trabajo colaborativo y la generación de contenidos de los estudiantes, privilegiando así la aplicación por sobre la transmisión de contenidos. Por otro lado, para introducir de forma efectiva las TAC en el proceso de enseñanza–aprendizaje a través de las metodologías activas supone transformar la práctica educativa desde el cambio de roles (docente y estudiantes) y su relación con el dominio digital, a través del desarrollo de competencias digitales. Finalmente, existen una gran cantidad de recursos digitales que pueden ser utilizados como parte de las metodologías activas, cuyo objetivo será superar el rol pasivo de estudiantes y docentes como consumidores de información, permitiéndoles adoptar un rol más activo en la generación de nuevos conocimientos a partir del intercambio con otros usuarios de la web.

Palabras clave

Aprendizaje, enseñanza, entornos virtuales de aprendizaje, metodologías activas, TAC.

1. Introduction

The global situation derived from the health crisis caused by the Covid-19 pandemic has been a trigger to rethink, and in many cases reaffirm, the need for a change for an efficient transformation in the educational field. According to the UNESCO-IESALC report (2020), around 166 countries decided to suspend face-to-face activities in their educational institutions at the basic, middle and higher levels, with the purpose of safeguarding the student population and the entire educational community. It is estimated that 87% of the worldwide student population was affected by these measures; this means that approximately 1,520 million students were affected.

As a consequence of the above, educational systems were forced to use non-face-to-face spaces and digital learning environments as alternatives to continue offering educational services and the implementation of teaching-learning processes. In the current context derived from this pandemic, certain shortcomings of educational institutions have become evident, especially in relation to infrastructure and teacher training in terms of knowledge and application of non-face-to-face modalities (Alcántara Santuario, 2020). However, it has also opened an area of opportunity to implement improvement strategies, particularly in relation to the interest in the use of resources and strategies to facilitate teaching through digital environments. Despite the aforementioned efforts, it must be recognized that the response was not always the most adequate from both teachers and students regarding the efficient use of digital tools and the development of digital competencies, but in record time (García-Peñalvo et al., 2020).

Based on what was described above, other aspects that have concerned the educational community derived from the challenges presented in the implementation of non-face-to-face modalities are, on the one hand, those that are closely linked to the development of learning in the virtual modality, i.e., guaranteeing meaningful learning with the help of technology; and on the other hand, the possibility of innovating pedagogical practice,

considering the adaptation of learning outcomes, objectives, processes and teaching-learning methods to the new situation, significantly modifying what has been done so far, without altering the educational project.

Given this scenario, perhaps one of the most favorable responses to overcome the challenges presented in terms of the development of learning in non-face-to-face modalities and the innovation of pedagogical practice is centered on the implementation of active learning methodologies mediated by CT, which are far from the virtualization of lectures (which in many cases has been the emergency solution to the health emergency, as shown by recent studies (Tejedor et al., 2020).

Following this order of ideas, the present work tries to give a perspective in relation to learning and active methodologies that, according to their purpose and design, can be applied in virtual learning spaces and environments and that allow, on the one hand, an adequate teaching-learning process, as well as a more efficient mediation of the teaching practice through the use of technology; and on the other hand, the generation of digital competencies of both teachers and students, which involve an adequate management of ICTs whose purpose is to make the most of the resources and tools available for interaction and creation of knowledge and assimilation of learning.

2. Learning in the context of active learning methodologies

To speak of learning in these times supposes recognizing it as a multidimensional process of the human condition where different ways of carrying it out converge, with singular styles, where a wide variety of contents interact and at different depths, as well as in differentiated contexts. In this sense, learning involves the actions of different actors who communicate according to the role of the moment, being able to modify or exchange among them; this supposes then that the interconnection between the actors, according to Herrera Pavo et. al (2021), "is given by activities developed jointly that allow students to assimilate, analyze and exercise what they have learned through concrete and meaningful experiences for their immediate context" (Herrera-Pavo et. al., 2021, p. 15). These authors also comment that these activities are developed through teacher mediation and the learning community in face-to-face and non-conventional modalities.

The aforementioned, according to the authors, implies then that the learning process through these activities "does not refer to the physical presence of the actors (teachers and students), but to the type of activity where these actors work collaboratively with each other, so that their actions are only understood and have meaning in the framework of achieving a common goal." (Herrera-Pavo et al., 2021, p. 15).

In order to implement the activities jointly and achieve the expected results, it is necessary to use those methodologies that refer to inquiry-based learning or commonly called active methodologies. Based on the idea of the previous paragraph, when talking about active methodologies, it makes sense to talk about active learning as a dynamic process where students can have authentic experiences and develop metacognitive processes in an autonomous and collaborative way. Applying these aspects, students, with adequate teacher mediation, will determine the pace and style of assimilation and generation of new knowledge based on their previous knowledge.

In this order of ideas and according to the report of the Association for the Study of American Higher Education (Bonwell and Eison, 1991), which points out that there are certain characteristics associated with the use of strategies that promote active learning, such as: a) students do more than just listen, they are involved in a higher order thinking process and are involved in collaborative activities; b) the transmission of information is

less emphasized and space is given for the development of students' capabilities, as well as the exploration of students' attitudes and values is emphasized.

Therefore, and following the approach of these authors, it could be indicated that active learning is learning "that involves students in doing and reflecting on what they are doing" (Bonwell and Eison, 1991, p. 45), fundamental elements for the teaching-learning process mediated by ICTs, which will be discussed in more detail below.

As mentioned in previous paragraphs, active teaching-learning methodologies aim to maximize the probability that students learn in situations where the contexts and scenarios proposed by the teacher in an intentional manner make sense. Therefore, in order to achieve this purpose, it is necessary to take into account some principles that allow the design of activities based on these situations under active methodologies.

For this purpose, the research of Ambrose (2010) is a clear guide to the scope of these learning principles, which in turn recognize it as a developmental process that intersects with other developmental processes in the life of the student, who possess, in addition to skills, knowledge and abilities, also social and emotional experiences that influence what they value, their self-perception and that of others, and ways to get involved in the learning process. These principles are articulated with each other and in real learning situations, besides being indivisible, so an easy way to understand these principles and good teaching practices is the association proposed by Espejo and Sarmiento (2017) to guide the relevant implementation of certain active methodologies. That said, the principles and their good practices are listed below in Table 1.

Principle	Example of good practice
Prior knowledge	Conduct a diagnostic assessment using different activities or applying different procedures.
The way in which students organize knowledge	Use graphic organizers - e.g., a concept map - both at the beginning and throughout the course (e.g., to summarize each unit)
Students' motivation	Use a motivational test at the beginning, middle and end of a course. Monitor student enthusiasm in each class.
To develop mastery of a topic, students must develop cognitive, attitudinal and procedural resources.	Clearly identify the resources associated with the competencies of the graduation profile and associate them to the learning outcomes of the course. Evaluate considering not only cognitive or procedural aspects, but also attitudinal and metacognitive aspects. Use a variety of evaluation procedures, among others, scales of appreciation and rubrics.
Goal-oriented practice coupled with focused feedback enhances the quality of student learning.	Socialize the learning results of the course with the students and specify them in a learning guide or syllabus. Generate a feedback system that provides information to students regarding their progress in the learning process.
Students' current level of development interacts with the social, emotional, and intellectual climate of the classroom.	Ask students how they feel about the course. Use group work techniques that allow the development of social bonds among students

To be autonomous learners, students must learn to monitor and adjust their approach to learning.	Establish a system that allows students to check their progress in the course. to check their progress in the course.
	Socialize and discuss with students the autonomous workload associated with the course. workload associated with the course.
	Discuss with students the study techniques best suited to the course techniques best suited to the subject matter of the course. Exchange experiences among students.

Table 1. Application of Susan Ambrose's learning principles. Source: (Espejo and Sarmiento, 2017, p. 14)

2.1 Active Methodologies

As described in the previous section, active methodologies are necessary to be integrated into the teaching-learning process, which can transcend from a reproduction of knowledge to a participatory dynamic of the actors involved in the entire educational process. Taking into account authentic learning activities, monitoring and follow-up strategies, as well as clear and meaningful evidence regarding the quality of what is expected to be taught, as well as effective interactions to achieve the objectives and demonstrate learning outcomes.

The above as part of a quality education simulating what society demands today, i.e., individuals with skills such as: autonomy, development of work in small multidisciplinary teams, participatory attitude, communication and cooperation skills, problem solving, creativity, etc., aspects that have to be contemplated in the education of the 21st century.

Now, with the incorporation and continuous research of active methodologies, we would expect an adequate change in teaching practices, not only in terms of a different vision of the purpose of education, but also to offer methodological tools with which both teachers and other education professionals can implement much more creative and reflective processes, with a solid base of technical and technological knowledge, in order to be able to transfer all these components to students so that they can continue learning throughout their lives.

Under this scenario, it is important to indicate that active methodologies respond to the socio-constructivist paradigm, which places the learning process in the search for the emancipation of individuals, combining high doses of autonomy with balanced processes of accountability that allow students to be responsible for their learning. Taking Barkley and Cross (2007) and Espejo and Sarmiento (2017) as a reference, active methodologies can be classified into two large groups, the first requires the development of planning, prioritization, organization, communication and knowledge mobilization skills, as well as the metacognitive component of the individual learning process of students, the latter given the need to reflect on each stage of the work they perform, evaluating their personal results and those of their group. Therefore, these require continuous work over time. Among this classification are: a) the case method, b) problem-based learning, c) project-based learning and d) inverted classroom.

For a better understanding and to outline what each methodology consists of, Table 2 below presents an excerpt from the work of Espejo and Sarmiento (2017) where a brief synthesis of the most relevant aspects of each one is presented.

Methodology	What does it consist of?	When to use it?	Time	Evaluation
Case method	Students should be able to identify the key aspects of the information presented as a case-problem, as well as determine a set of possible solutions, propose strategies for their solution, and make decisions regarding the associated problems.	It can be implemented with students of any year by adjusting the proposed cases and providing adequate feedback for individual and group work. .	It is recommended to occupy it within a whole thematic unit.	This is done through the results of the proposed solutions to the case, both individually and as a group. An instrument based on criteria (rubric or checklist) is required.
Problem-based learning	It consists of directing the student towards learning through a problem; that is, before the students acquire a certain knowledge, they are offered a problem so that, through it, they discover what they need to know to solve it.	For its implementation, it is important to consider the level and characteristics of the students in order to choose problems that are understandable to them. For this reason this methodology tends to work best with students who already have a certain base in the discipline of study.	It is suggested that the teacher allocate a certain number of hours per week to the students' work, so that he/she is present and can accompany the process. .	This is done through the delivery of preliminary reports at the end of each of the following stages: a) analysis of the problem and determination of the knowledge required to solve it, b) result of the research on the necessary knowledge, and c) final integration and solution proposal. At the end of the process, the teacher can encourage hetero, co and self-evaluation through rubrics

				prepared for this purpose.
Project-based learning	It is carried out by working in groups of students, who choose a topic according to their interests and elaborate a related project. The working group has the necessary autonomy to establish its objectives, planning and decision making, having the necessary time to reflect on their actions and guide their work.	It is generally used with students in higher years, but strictly speaking it can be adapted for students of any year by adjusting the proposed topics and the degree of autonomy required for the proper development of the project. .	It is recommended to occupy hours over an academic period. It is possible to use shorter times, but it will require adjusting the planning so that it is feasible for the students.	This is done through the preliminary deliverables and the final deliverable that have been agreed upon. It is important to include also co- and self-evaluation in relation to the work in general and to the group dynamics in particular.
Inverted classroom	This considers the definition of a set of competences to be developed by the students, transferring, on the one hand, the responsibility for the apprehension of contents to the learner; and on the other hand, to the teacher, the organization and prioritization of contents in two types: those that will be acquired by direct teaching and those that are better placed in experimentation. .	It can be applied in all curricular areas, as well as within the different levels of education: basic, higher basic, high school, higher education and even adult education.	It is recommended to use this methodology throughout the cycle, period or module a thematic unit. .	This is done through the results of individual and group evaluations, as well as evaluations of the application activity.

Methodologies to be used throughout a didactic unit. Source: (Espejo and Sarmiento, 2017, pp. 47-67)

On the other hand, the second classification, although they are not strictly speaking methodologies but specific techniques, allow "activating" a learning moment, encouraging

participation, collaborative work and the application of student content. These, unlike the previous ones, only require a specific time for their implementation. For the purposes of this paper, it is important to mention that this group of techniques allows connection with the learning mediated by CT, which we will address in the following section.

In addition, it should be noted that their purpose is to make the most of direct contact time with students, thus favoring application activities over the transmission of content. These include techniques: a) to encourage class discussion, b) for reciprocal teaching, c) that use graphic organizers, and d) focused on writing.

3. TAC (CT) -mediated learning

The term ICT refers to the use of Information and Communication Technologies (ICT) from a more formative and pedagogical dimension. Thus, according to Lozano (2011) "ICTs go beyond merely learning to use ICTs and are committed to exploring these technological tools at the service of learning and knowledge acquisition" (Lozano, 2011, para. 7).

Therefore, to effectively introduce ICT in the teaching-learning process involves transforming educational practice by changing roles (teacher and students) and the relationship of these actors with the use and digital domain, through the development of digital competencies.

The above has as a consequence to visualize the teaching practice as an opportunity for change and improvement, since, on the one hand, the strategies implemented in conventional situations are no longer satisfactory for the new scenarios where the use of digital environments is privileged. This leads to the redefinition of the teaching role in relation to learning activities, tasks, knowledge, attitudes and the formation of competencies, which today are mediated by technology. Therefore, the teacher "must cease to be an instructor who dominates knowledge, to become an advisor, guide, facilitator and mediator of the teaching-learning process" (Segura et al., 2007, p. 6).

On the other hand, the role of students is also changed by the use of digital tools, since it implies a greater motivation in learning (Area Moreira, 2010; Pedró, 2011), as well as a different attitude towards the use of such technology, which enriches learning and contributes to gain self-confidence (Pedró, 2011).

However, as commented by Salinas (2004), these educational resources need to be mastered for the construction of knowledge; in that sense, students require new skills to face this reality. Therefore, the role of students is no longer limited to a simple reproducer of content, but "they must become intelligent and critical users of information, for which they need to learn to search for, obtain, process and communicate information and convert it into knowledge" (Segura et al., 2007, p. 6). In line with what has been described in the previous paragraphs, it is necessary to analyze the educational and technological context in which teaching practice is carried out. This means that the characteristics of the students, their capabilities, skills and competencies to be developed, the available resources, among others, must be considered. The above with the purpose of deciding between those methodologies, active techniques and TAC resources that allow students to acquire knowledge from the different learning styles they have developed. That is, allowing them to be the protagonists of their own learning mediated by technology and digital environments.

Now, the incorporation of ICT in different educational scenarios and contexts has, in addition to the purposes already mentioned in previous lines, to overcome the passive role of both students and teachers as consumers of information, allowing them to adopt a more active role and allow them to position themselves as creators of content and generators of new knowledge from the generation and exchange with other web users.

3.1 Types of Learning and Knowledge Technologies according to their purpose

According to Velasco-Rodríguez (2017) there are a large number of TAC resources with which students can create different contents and generate meaningful learning. These resources allow them to be the protagonists and responsible for their teaching-learning process, also from the mediation of the teacher, which consists of the presentation, collaboration, supervision and accompaniment in the use of the TACs, a greater potential can be exploited.

In this sense, this author presents a set of TAC that, according to their purpose can be used as part of the learning strategies in digital learning environments, commonly also called EVA. The purpose, resources and a brief description of the TAC are presented in Table 3 below.

Purpose	TAC Resource	Description
Video editing	Quik, Splice, Stupeflix y 123 apps	create and edit videos in a simple way
Interactive videos	Vizia y EDpuzzle	turn any video into an interactive lesson
Audio	SoundCloud, Audacity, Peggo y Vocaroo	create audio files and share them
Image - infographics	Genially, Typorama, Fotojet y Piktochart	create static or dynamic graphical content for various purposes
Classroom management	Moodle, Blackboard, Canvas, Edmodo, Classroom, Doceo y Additio	managing a teacher's daily life: lists, evaluation, rubrics, resource bank, group organization, etc.
Gamification	Cerebriti Edu, Quizizz, Trivinet, Jeopardy Rocks, Playbuzz, Triventy y Arcademic	Generate interactive activities using playful resources for curricular content.
Evaluation	Apester, Kahoot!, Google Forms y Quiz Revolution	check the learning acquired through resources and evaluation tools.
Communication	Homeroom, Otter y Blogger	establish fluid communication between all members of the educational community
Presentations	Emaze, Genially, Powtoon, Prezi, Sparkol y Haiku Deck,	to make presentations in a simple way and with attractive and professional results
Activity generators	Educaplay y Kubbu	create your own interactive activities in a personalized way
Collaborative work	Padlet, Team Maker, Teamweek, Meetingwords y Quip	create resources and didactic tools for shared work
Search engines and safe navigation	YouTube Kids y Kiddle	securely search for videos and information
Copyright	Pixabay, Iconicons, Skitterphoto, Sample Focus y pngimg	search for royalty-free images, audio files, icons, etc. to use in our projects
Mind maps	Coggle y WiseMapping	create digital mind maps
Languages	Lyrics training, Locallingual y Forvo	learn languages through real audio and interactive situations

Productions	Pixton, Tiki toki y Storybird	create comics, timelines or stories

Table 3. TACs according to their purpose. Source: (Velasco-Rodríguez, 2017, pp. 774-775)

Taking into account the above, it can be evidenced that the use of ICT allows, on the one hand, a paradigm shift in the school and towards quality teaching, where motivation and improvement of the expected results are achieved (Pedró, 2011). And on the other hand, the possibility that technologies transcend from a merely instrumental element to enhance a current and efficient educational model, which responds to the educational needs of citizens" (Castañeda-Quintero and Adell-Segura, 2013, p. 45).

4. Conclusions

As conclusions, it could be stated that learning, being a continuous and diverse process, allows human beings to acquire the knowledge and competencies necessary to face life and be able to face the challenges of the 21st century. In accordance with this idea, it should be recognized that learning today is not only built in the classroom but also outside the institutions of any educational level; however, the role that educational institutions have acquired in recent years is to reinterpret knowledge and learning in an active and interconnected way based on the pedagogical dialogue between the student, knowledge, technology and the teacher (De Zubiría Samper, 2006, p. 2).

Under this scenario, it would be expected that teaching-learning transcends from a reproduction of knowledge to a participatory dynamic of the actors involved in the entire educational process; where both active methodologies are taken into account where learning activities can be established, strategies for monitoring and follow-up, as well as the development of digital competencies to make the most of the application of ICT to motivate students to enhance their creativity and increase their multitasking skills, as well as take advantage of synergies between teachers and students through virtual learning environments.

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Educaplay: a gamification tool for academic performance in virtual education during the pandemic covid-19

Educaplay: una herramienta de gamificación para el rendimiento académico en la educación virtual durante la pandemia covid-19

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Abstract

This research is based on the use of the gamification tool Educaplay and its contribution to the academic performance of elementary school students. The objective was to analyze the use of Educaplay as a didactic resource within virtual education and how this process improves students' performance, taking into consideration the change of model and application of new methodologies within virtual classes. The methodology applied is of an experimental-exploratory type, through a quali-quantitative approach that was collected by applying a survey identified as pretest which was validated by Cronbach's Alpha statistic with a value of 0.842 and subsequently the application of the Technology Acceptance Model (TAM) as posttest; the activities were developed using the SAPIE methodology; the study population was 70 elementary basic education students to whom the experiment was applied based on gamification resource using the web tool Educaplay. The results of the research allowed to know if the students improved their academic performance with the use of gamification resources that motivate their active participation, collaborative work, and that the teacher is the one who generates his own resources, based on the needs of the students.

Keywords

Education, e-learning, gamification, academic performance, ICT, virtual education.

Resumen

Esta investigación se fundamenta en el uso de la herramienta de gamificación Educaplay y su aporte en el rendimiento académico de los estudiantes de Educación Básica. El objetivo fue analizar la utilización de Educaplay como un recurso didáctico dentro de la educación virtual y cómo este proceso mejora el rendimiento de los estudiantes, tomando en consideración el cambio de modelo y aplicación de nuevas metodologías dentro de clases virtuales. La metodología aplicada es de tipo experimental-exploratoria, mediante un enfoque cuali-cuantitativo que se recabó aplicando una encuesta identificada como pretest la cual fue validada mediante el estadístico Alfa de Cronbach con un valor de 0.842 y posteriormente la aplicación del Modelos de Aceptación de la Tecnología (TAM) como postest; las actividades fueron desarrolladas mediante la metodología SAPIE; la población de estudio fueron 70 estudiantes de educación básica elemental a quienes se aplicó el experimento basado en recurso de gamificación utilizando la herramienta web Educaplay. Los resultados de la investigación permitieron conocer si los estudiantes mejoraron su rendimiento académico con el uso de recursos de gamificación que motivan su participación activa, el trabajo colaborativo, y que el docente es quien genera sus propios recursos, basados en las necesidades de los estudiantes.

Palabras clave

educación, educación virtual, gamificación, rendimiento académico, TIC.

1. Introduction

The use of collaborative tools is linked to the technological field, which contributes to great changes to transform virtual environments into adequate spaces for students at different educational levels. Currently, teachers must be previously trained for the proper use of collaborative tools, leaving aside the traditional teaching model, where the student does not acquire new and innovative knowledge, while these tools will facilitate their learning, it is possible to access digital books and quick information.

The fundamental key to change the traditional educational model for a technological one is that both teachers and students are involved in the use of new tools to improve their

academic performance. These changes are reflected in the participation of each student, in a constant and significant learning, in the fluid communication between teacher-student, in the construction of new knowledge, guiding them to an autonomy so that they can develop by themselves. This does not mean that collaborative tools replace the work of the teacher, the classroom or the blackboard, but rather that they are a support that contributes to and enriches the students' knowledge to prepare them for a new virtual environment.

The use of tools in times of COVID-19 requires changes in educational practices directed at teachers. It is essential to point out that the use of these tools within the teaching processes, which are established by teachers in their curricular design and in the practices derived from the teaching-learning process, allows students to become consumers of these resources. It must be taken into account that students need the guidance and accompaniment of their teacher because they are the ones who motivate the use and discovery of these tools, allowing them to improve their competence and academic performance. Students will be able to handle these educational tools with ease, from anywhere in the world, wherever they are through any electronic device; a fundamental aspect for the correct use of resources in reducing the risks of COVID-19 contagion, regardless of the distance between the teacher and the student if there is meaningful learning (Ramandeep et al., 2021).

Education is undergoing an accelerated transformation because teachers are changing their role as providers, as knowledge is online and no longer needs someone to provide it. Students need someone to reinforce knowledge and guide teaching, for this reason, it is necessary to adapt to technology and the services it offers. Learning with the Educaplay tool is fun, interesting and playful, it is a tool that does not give place to traditional learning, where students feel open to the pedagogical process, achieving to deepen and solidify their knowledge with capacity for analysis and synthesis, contributing to meaningful learning to form useful people in society.

Teachers' performance is almost totally linked to the emotions that trigger their conduct and behavior. In this sense, teachers are not only considered as carriers of theoretical and conceptual contents, but as beings that change the educational and cognitive awareness of students, classes become a space charged with well-being and good relationships by transmitting positive emotions, in which the practice of values, the development and strengthening of affective communication also intervene. When teachers carry out their work in the most intelligent way possible, and with the student's well-being in mind, they are promoting the balance of the cognitive and emotional dimensions, since learning is not only theoretical content but also social and affective relationships (Jingcheng et al., 2020).

There are several factors why students feel unmotivated, and sometimes have lack of interest in a firm; therefore, the use of methodologies, strategies, resources and techniques appropriate to virtual education in a certain way will minimize these relevant factors in young university students. For a child or adolescent to excel in his or her studies, family dynamics are relevant if the family to which he or she belongs is functional, the children will reflect a high level of performance in the institution. However, if the family is dysfunctional, the children will have disadvantages in school and will have recurrent absences. It will be possible to notice the lack of rules along with violent actions towards the children within the family. Therefore, there will be a total lack of motivation for their studies, resulting in poor school performance and even dropping out of school (Min-Jeong and Joon-Pio, 2021).

2. State of the art

A student's performance depends on an institutional culture, which is driven by rules and norms for the entire educational community. It is possible to find institutions that are based

on discipline, that give priority to school performance in conventional areas, that guarantee high scores in their evaluations, and that develop students' individual talents and abilities such as creativity, reasoning, reading, etc. Therefore, families have the right to choose the education they prefer for their children, but it is their obligation to know each one of the subjects (Román-Calderón et al., 2021).

2.1 Education and the Pandemic

In times of pandemics, different forms of coexistence have emerged. People have learned to live in confinement as a necessary and obligatory way, with the intention of avoiding contagion and preserving the health of all inhabitants. However, this brings with it some consequences such as the reaction of collateral effects in adults and the negative effect on children as they are the most vulnerable in this situation. That is why the academic performance of primary school students has been decreasing more and more, due to the stress caused by the confinement, a reality that is currently experienced.

Children do not have free or adequate space, adequate technological resources and an optimal Internet connection to resume their classes in virtual mode. They are afraid of getting infected or of a family member catching the virus, and what is worse, they are afraid of losing a loved one. Because of all these factors, children stop thinking about their studies, do not do their homework, do not attend classes and their thoughts are focused on other situations, which will affect their student life in the long term (MINEDUC, 2020). Parents are the ones who play an important role in education, they are the ones who assume the role of teachers, give reinforcement to their children and make them feel self-confident so that the child has an optimal school performance at the end of the school year (Behl et al., 2021).

The implementation of the use of 3.0 collaborative tools in the educational environment has generated a much more meaningful and, above all, quality learning process. In the same way, the student will work autonomously in the construction of his knowledge, also allowing him to be much more investigative (MINEDUC, 2020).

In addition, the Mineduc points out that platforms have been designed for students to create their projects based on technologies, and that there are several online courses offered by the Ministry of Education with topics related to technological tools 3.0 (MINEDUC, 2020), which will facilitate learning. The main objective of creating these virtual platforms is that they motivate both the teacher and the student to be much more investigative and thus generate experiential learning (Nikoletta-Zampeta et al., 2021).

2.2 Collaborative tools

Collaborative 3.0 tools have grown rapidly in the last decade, so one must be responsible and use them appropriately. They have been implemented in the educational environment, generating a better teaching process with quality and warmth to each of the students, trying to train students with skills and abilities to face digital barriers (Zamzami et al., 2020).

Collaborative tools are computer applications that help to communicate and work in groups without the need to be together in the same physical space, thanks to these tools it is possible to share different information and perform activities in different areas. Collaborative tools are a system of applications that contribute to the interaction of users even if they are not in the same place, thanks to collaborative tools, it is possible to share informative data in different formats such as text, video, audio, and many more. Likewise, new information can be created through the intervention of users, and thanks to the accessibility of the Internet, it can be published at that precise moment (Peña et al., 2021).

Thanks to collaborative tools, it has been possible to encourage teamwork, as well as to provide the student with pedagogical reinforcement in different areas of study

(Mathematics, Language and Literature, Social Sciences, Natural Sciences, etc.). Its main objective is that it enables meaningful learning for the student and helps the teacher to have countless applications to work together on the different tasks assigned in the classroom (Behl et al., 2021). Likewise, collaborative tools enhance aspects such as self-learning, reasoning and, above all, collaborative learning. For this reason, students' learning will be effective, achieving an environment in which it will be easier for them to perform the tasks of the educational process (Jaramillo-Baquerizo, 2021).

Collaborative tools are an extremely necessary solution to carry out virtual classes, since they support interaction between teachers and students, contribute to the problem of distance, strengthen reasoning, self-esteem and, above all, collaborative learning (Krath, 2021).

Among the advantages of collaborative tools, the following can be highlighted:
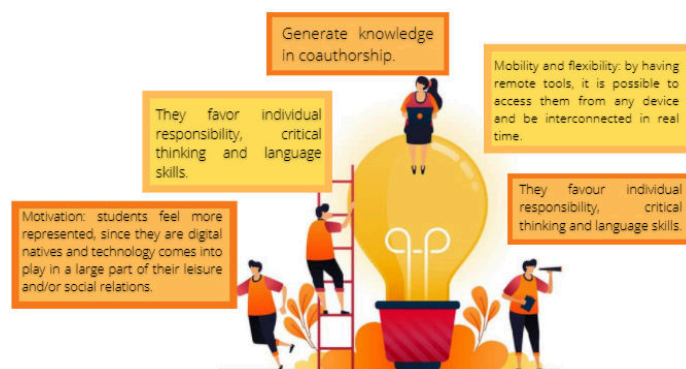
Figure 1. Advantages of Collaborative Tools. Source: (Krath, 2021)

The disadvantages of collaborative tools can be the risk in the first experiences if users are new to this technological practice, because they may find it difficult and complex. Therefore, the teacher must be well trained to give the right explanation so that the student has a good experience of group work and above all, of working with collaborative tools. Another disadvantage is the dependence on the IT infrastructure, i.e., hardware, software and networks to work with, taking into account the accessibility of many students to the Internet (Parra-González et al., 2021).

2.3 Educaplay

Educaplay is one of these collaborative 3.0 tools, which is available to everyone as it is a free web 3.0 tool and allows users to perform playful and recreational activities to have an interaction between the teacher and the student. This program can be used in three different languages: Spanish, French and English, in this tool the activities are dynamic and above all entertaining, which helps the teaching-learning process in each of the students. The EducaPlay tool is essential for the interaction in the educational process, since it provides different activities thanks to which the student will achieve a significant learning, and above all, will learn while playing.

It is a tool that allows to work efficiently; this tool is applied at all educational levels, from kindergarten to university, with various forms of use such as evaluation tools, reinforcement activities, motivational games, a large repository of games made by other users, detection of previous knowledge, etc. Thanks to this platform, teachers save their time in planning their classes according to the group of children they are working with. Due to the large number of students, a learning community has been created by sharing knowledge through innovative activities.

2.4 Characteristics

Educaplay, being a versatile technological tool, has several features, which will be mentioned below

:
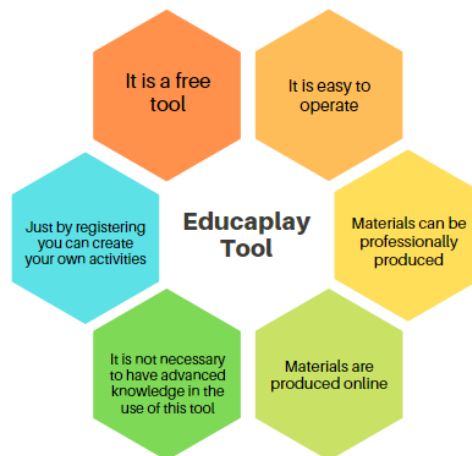
Figure 2. Characteristics of Educaplay. Source: (Garrido-Astray et al., 2019).)

The features of the Educaplay tool are basic, it is not necessary to be an expert in programming to be able to handle such a tool, and it offers many activities for the benefit of the student and the teacher (Garrido-Astray et al., 2019). Educaplay is an online platform for the creation of interactive activities, where materials are created online and remain on the platform so that they can be shared through links. It is a Web 3.0 tool that has taken a lot of strength in the creation of educational materials, and this is due to the ease of use and, above all, the availability of the material created, which automatically remains on the network to be shared with links on Pages, Blogs or Educational Platforms (Rabab-Ali, et al., 2021).

Advantages	Disadvantages
• Attractive and easy to handle activity. • Images and audio files can be inserted (for non-reading children and people with disabilities). • It is not necessary to install any software on the computer, only the Flash plugin. • It offers its content in three languages: English, French and Spanish.	• For the dictation activity, it is necessary to have a microphone and speakers. • As it is a standard program, now of using it, any small error on the keyboard will lower the result. • Once downloaded, the resource can no longer be modified. • Some activities are limited in their use.

Advantages and disadvantages of Educaplay

Finally, having the risk of a perception of the information; which happens in a face-to-face or disconnected way through audios, videos, or resources that the teacher has made in

advance, in such a way, the student will have the perception that the activities do not require more effort, and that they are not important (Farjón, Smits, & Voogt, 2019).

3. Methods and materials

The present research with the topic "Educaplay collaborative tool and the academic performance of seventh grade students" is experimental-exploratory, the modality applied in the research was carried out through a mixed approach: starting from a qualitative basis, having an interpretative approach with the subjects of study, and as a second point, with a quantitative approach through data tabulation. Once completed, the survey technique was used with its instrument, the questionnaire structured on a five-point Likert scale.

For the collection of information, a structured questionnaire was used as the research technique. This questionnaire was composed of questions related to the topic of study to find out whether seventh grade elementary school students use the collaborative tool EducaPlay to improve their academic performance. Thus, with the information collected, possible conclusions were drawn based on the results obtained.

The structured questionnaire was composed of 24 questions, 17 Likert scale questions and 2 dichotomous questions. This questionnaire allowed the researcher to obtain the required information in a useful and accurate manner based on the objectives set for this research. This survey was applied to seventh grade students with the objective of knowing the reality of the students regarding the use of collaborative tools according to their educational level and the didactic sequence of the class.

The researcher worked with the entire population of 70 students and 4 teachers of seventh grade of elementary education. For this research work, it was hypothesized that the collaborative tool Educaplay improves the academic performance of seventh grade elementary school students through virtual education.

For the development of the activities through the Educaplay tool, the S.A.P.I.E. methodology was used. This methodology is a set of research methods that can be applied to any subject, which allows the interaction between the teacher and the student in a more direct way in the different tasks presented, considering the following steps: selection, analysis, planning, interpretation and evaluation.

For hypothesis testing, the one-sample test statistic was applied; therefore, the most appropriate statistic for these samples (questions 6 and 17) was the Chi-square

.

Null Hypothesis	Test	Sig	Decision
The categories of 3.0 tool types used to learn to occur with equal probability.	One-sample chi-square test	.000	Reject the null hypothesis
The categories of tools to evaluate occur with equal probability.	One-sample chi-square test	.000	Rechazar la hipótesis nula

Table 2. Summary of hypothesis testing

H1: The collaborative tool Educaplay improves the academic performance of seventh grade students.

To corroborate the hypothesis, the Kolmogorov Smirnov (K-S) population statistic was used to determine the rejection of the null hypothesis

		Types of 3.0 tools you use to learn:	Evaluation instrument
N		25	25
Normal parameters,b	Mean	2.76	3.14
	Standard deviation	3.727	1.824
More extreme differences	Absolute	.491	.401
	Positive	.491	.401
	Negative	-.318	-.218
Z de Kolmogorov-Smirnov		2.252	1.838
Sig. Asintót. (bilateral)		.000	.002

a. The distribution of the contrast is Normal.

b. They have been calculated from the data.

Table 3. Kolmogorov-Smirnov test for one sample

Having a p (value) lower than 0.05 in the most representative questions for this research, the final decision is to reject the null hypothesis (H0) and accept the alternative hypothesis (H1), which mentions that the collaborative tool Educaplay improves the academic performance of seventh grade students.

To measure the degree of internal consistency, Cronbach's alpha reliability coefficient was applied, whose resulting value was .842, equivalent to good. This analysis attempts to determine the degree of reciprocal relationship of the items and is presented below.:

Alfa de Cronbach	N of elements
.842	17

Figure 3. Cronbach's alpha

4. Results

The results presented below were taken from the instrument used as pretest, which consists of 24 questions, 17 on a Likert scale, one dichotomous question and the remaining 6 of sociodemographic information, in turn, the most representative questions within the research were selected.

Question 6. How often do you use technological tools 3.0 for learning?

	Answers	Percentage
Never	1	1.41
Rarely	0	0.00
Occasionally	3	4.23

Often	59	83.10
Very often	8	11.27
TOTAL	**70**	**100.0**

Table 4. Frequency of use of Web 3.0 tools by students

Figure 4. Frequency of use of Web 3.0 tools by students.

In this question 59 students indicate that they frequently use 3.0 technological tools to learn. In addition, 32.0%, equivalent to 8 students, state that they use technological tools to learn very often. In addition, 12.0%, equivalent to 3 students, state that they occasionally use technology to learn. Finally, 4.0%, equivalent to one student, indicated that they never use technological tools for learning. It should be noted that these data are taken at a time of virtual education due to COVID-19.

Question 17. Do you think that teachers should generate their own resources based on Web 3.0 tools for the development of collaborative work?

Alternatives	Answers	Percentage
Totally agree	9	12.86
Agree	61	87.14
Neutral	0	0.0
Disagree	0	0.0
Strongly Disagree	0	0.0
TOTAL	**70**	**100.0**

Cuadro 1. Own resources based on web 3.0 tools

Figure 5. Proprietary resources based on Web 3.0 tools

Of a total of 70 students surveyed equivalent to 100% of the sample, 64.0% equivalent to 61 students agree that teachers generate their own resources based on web 3.0 tools for the development of collaborative work, while the remaining 36.0% equivalent to 9 students indicate that they totally agree that teachers generate their own resources based on web 3.0 tools for the development of collaborative work. Therefore, the majority of students say they agree with teachers generating their own resources based on web 3.0 tools for the development of collaborative work among all students in charge. It was observed that students performed better when they were presented with group work in tools such as Crosswords and Quiz from the Educcaplay tool.

4.1 Application of the TAM model

Question 1. The use of web 3.0 tools allows me to do my work faster.

Alternatives	Answers	Percentage
Strongly Disagree	0	0.0
Disagree	0	0.0
Neutral	0	0.0
Agree	8	32.0
Strongly Agree	62	68.0
TOTAL	**70**	**100.0**

Table 6. Use of web 3.0 tools to carry out the work.
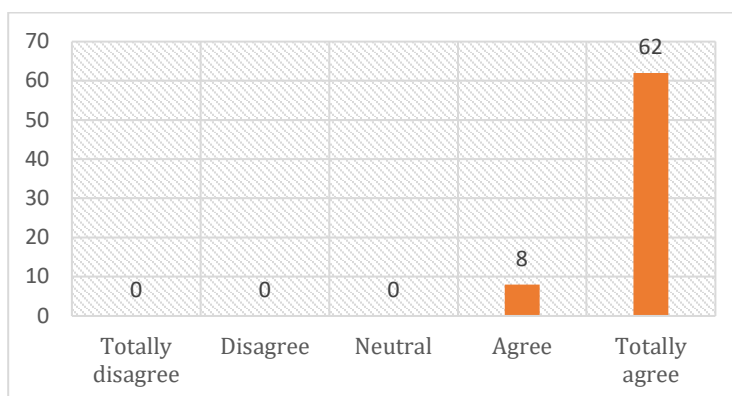
Figure 6. Use of web 3.0 tools for the realization of works.

In this question 68.0% equivalent to 62 students indicate that they totally agree with the use of web 3.0 tools to do their work much faster, and 32.0% equivalent to 8 students state that they agree that the use of web 3.0 tools allows them to do their work faster. Most of the students totally agree that web 3.0 tools allow them to do their work faster since it is easier to search for information and do the work according to the student's needs.

Question 5. In general, I find the Educaplay tool useful in my work in virtual classrooms.

Alternatives		Questions	Percentages
Totalmente	en	0	0.0
desacuerdo			
En desacuerdo		0	0.0
Neutral		0	0.0
De acuerdo		5	40.0
Totalmente	de	65	60.0
acuerdo			
TOTAL		**70**	**100.0**

Table 7. Educaplay is useful for classroom work
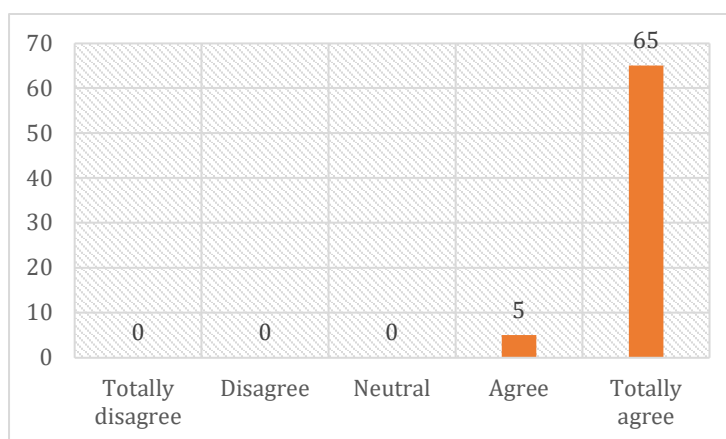
Figure 7. Educaplay is useful to work in classrooms

Out of a total of 70 students surveyed, equivalent to 100% of the population, 60.0% equivalent to 65 students affirm that they totally agree that the Educaplay tool is useful in virtual classes. On the other hand, 40.0% equivalent to 5 students indicate that they agree with the statement. This means that many students totally agree that the Educaplay tool is useful in the work of virtual classes, the reason is that it is basic to use, and there is no need to download an app.

5. Conclusions

The collaborative tool Educaplay is a virtual platform, which due to its versatility and ease of use, has become ideal to develop the teaching and learning process of the different subjects of the seventh grade of primary education, contributing to dynamize and innovate knowledge, This has helped to dynamize and innovate knowledge, taking students and teachers out of the monotony by learning new techniques and developing the activities found on the platform, such as crossword puzzles, word searches, riddles, completing or ordering words, among others, in order to improve the academic performance of students, which will be reflected in their grades.

Collaborative tools are an essential contribution to education, since it is being taught from home (virtual classes). The most complete tools used for virtual education are Kahoot, which allows teachers to create quizzes to evaluate in the form of contests to reinforce students' knowledge; another important tool is Mindomo, which allows the elaboration of mind maps as well as monitoring; Quizziz is a tool that allows teachers to evaluate knowledge through multiple choice questions; and finally the collaborative tool Educaplay, which facilitates the creation of multimedia activities framed in the educational environment, the same that will allow meaningful learning to the student.

Collaborative resources based on Educaplay develop teamwork in students, promote an adequate leadership in virtual education, as well as the improvement of academic performance, since today's students rely on dynamic, creative and intuitive tools.

Acknowledgments

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Abstract

Faced with the health emergency that has occurred since 2020 due to the global coronavirus pandemic (COVID-19), society had to adapt to new contexts with the help of Information and Communication Technologies (ICT). Face-to-face work was interrupted in its daily activities by the mandatory confinement and at the same time the virtual modality was

chosen, which for several years had already been applied in distance higher education and in areas of the digital economy, but now it was strengthened by the need to continue fulfilling the same work specifically in the educational field. The use of ICT has become an essential element, and under this need social actors with different realities converged, so the present study aimed to reveal which were the forms of access to information and communication by students of the National University of Chimborazo (UNACH) during the year 2020. A quantitative diagnosis of the percentage of connectivity, type of service, with a descriptive non-experimental transactional design in reference to access to technological devices that university students have was performed. The results obtained in this investigation allowed to know that 70% of students of the 4 Faculties that conform the UNACH during the year 2020 made shared use of devices with other members of the family to execute their academic activities and telework within the home.

Keywords
Context, connectivity, confinement, covid19, devices, family, ICTs.

Resumen
Frente a la situación de emergencia sanitaria ocurrida desde el año 2020 por la pandemia mundial de coronavirus (COVID-19), la sociedad tuvo que irse adaptando a nuevos contextos de la mano de las Tecnologías de la Información y la Comunicación (TIC). El trabajo presencial se vio interrumpido en sus actividades cotidianas por el confinamiento obligatorio y a la par de aquello se optó por la modalidad virtual que durante varios años atrás ya se aplicaba en la educación superior a distancia y en ámbitos de la economía digital, pero ahora se vio fortalecida por la necesidad de seguir cumpliendo la misma labor específicamente en el campo educativo. La utilización de las TIC se ha convertido en un elemento imprescindible, y bajo esa necesidad confluyeron los actores sociales con distintas realidades, por lo cual el presente estudio tuvo como objetivo revelar cuales fueron las formas de acceso a la información y la comunicación por parte de los estudiantes de la Universidad Nacional de Chimborazo (UNACH) durante el año 2020. Se realizó un diagnóstico cuantitativo del porcentaje de conectividad, tipo de servicio, con un diseño no experimental transaccional descriptivo en referencia al acceso a dispositivos tecnológicos que tienen los estudiantes universitarios. Los resultados obtenidos en esta investigación permitieron conocer que un 70% de estudiantes de las 4 Facultades que conforman la UNACH durante el año 2020 hicieron uso compartido de dispositivos con otros miembros de la familia para ejecutar sus actividades académicas y de teletrabajo dentro del hogar.

Palabras clave
contexto, conectividad, confinamiento, covid19, dispositivos, familiar, TIC.

1. Introduction
The health crisis caused by the coronavirus (Covid-19) since April 2020 turned technology into that alidade to continue advancing with the tasks of daily life, being a necessary alternative to streamline services that in another era would have meant a partial or total paralysis of activities. Thus, as a result of these situations generated by the pandemic, a process of investigation was carried out to show through this research work the situation of higher education students who, from different sectors of Ecuador, found themselves in the need to continue their academic performance (Chirinos et al., 2020).

The National University of Chimborazo (UNACH) since its creation in 1995 has provided an education in a face-to-face manner and its curriculum responds to it, however, since 2014 it adopted a Blearning model with its Moodle platform, i.e. it was adapting to a combined

modality between the face-to-face and the virtual, which allowed both synchronous and asynchronous classes with students in 2020 to be carried out under this not so unknown context. However, this research is based on the reality experienced by each of the members of a family and how they had to adapt to this new modality due to the same need to have technological equipment, connectivity, and even the knowledge for the use of these technological services from the basics to the most advanced; to this is added factors such as sharing the same learning environment, the economic reality within the home, among others.

This work takes relevance from this situation of social nature that allowed to know how communication was carried out during this time of confinement between the actors belonging to the family, of which we highlight the university students and the use they gave to the tools and digital platforms in combination with the so-called teleworking. The contribution of this study is relevant not only for the fact of carrying out an investigation by time of pandemic, but because it became notorious from the obligatory nature of taking shelter in a virtual way to know in depth the situation of a society that currently lives the Digital Age. However, a journalistic note of El Mercurio Newspaper called "Education and pandemic" highlights that the educational field still remains an emergency situation where the policies adopted by the forced social distancing, have modified the conditions of a formal education in its infrastructure and communicative structure and were modified by turning to digital platforms, where teaching is separated from conventional classrooms and homes were transformed into school work spaces (Negrete, 2020).

Then, during this modality, the true condition of infrastructure and available resources was evidenced, especially in each of the homes of university students, such is the case presented in this research of those who belong to UNACH, since they come from different social conditions and from different regions and sectors of Ecuador (Table 1).

2.   State of the art

Universities worldwide were no exception to move almost immediately and adopt the modality of synchronous classes through virtual platforms, a very worrying fact to know if the equivalence was going to give the same results in their students to continue with the same or better learning percentage, as in the face-to-face, that is where many relevant globalized research questions begin to arise. Now that we have been able to experience this phase of digital transformation of the university, it would be a big mistake to repeat and face situations without adequate reflection and planning. Francisco García in his speech at the IX International Digital 2020 Conference, highlights that perhaps it was evidenced that the University in innovation issues is not as mature as it was thought, which invites to take seriously the strategic and leadership factor of the rectorial teams to build a digital, inclusive, participatory and especially human university (García-Peñalvo, 2020).

Under this approach, the first point to analyze is the level of the so-called "Digital Divide", a term often used to define the lack of access to connectivity or the use of technological equipment, whether smartphones, laptops or desktop computers; but as shown in Figure 1, it is an abyss that grows over time, over those aspects that are notorious in the imperative requirement to combine academic activities with technology, as it happened since March 2020 with the so-called virtual classes, which was only a meeting via internet by teachers and students through videoconferencing. Therefore, referring to a digital gap also implies those innovative methodologies on the part of teachers, in trying to resort to pedagogical patterns in the adaptation of the face-to-face to the strictly online, and that in the end ended up becoming a space where only publications with text content in PDF format and videos from the Youtube platform were shared with students.

Figure 1. Digital Divide, adapted from (García-Peñalvo, 2020)

If we explore the reality of universities around the world, we see that "this global shift to online learning follows the example set by universities in China, where the outbreak began. Such rapid global adoption of online education is astounding. Before the coronavirus, the use of online learning in higher education had shown a slow pace of change" (Abreu, 2020, p. 2); and now it is neatly becoming the only option, especially if a confinement is repeated whatever the reasons, therefore, the needs arise to not only ask if it should be done, but how fast it can be done.   The role of the University in the context of the pandemic entails projecting itself into an uncertain future where the lack of resources, both material and technological, will always seek to mark a limit, and where it often becomes the usual excuse; However, now with this online modality, subjects must be adapted through continuous communication with students and the use of both synchronous and asynchronous tools, and through an amazing response capacity, in record time, spaces for online productions and practices were created to assist teachers; there were also opportunities to send materials, create contents, learning and teaching resources, etc.

From this joint work of authorities and teachers to build those spaces equivalent to what existed in face-to-face and now in virtuality with a view to continuing with the academic work, other personal circumstances arise in students and their families, starting from reflecting on whether they have a computer for exclusive use and their own high-speed connectivity for proper monitoring of virtual teaching (Cabrera, 2020) notes that the educational level of families, although not exclusively, acts as a gradient of inequality (Pérez-López et al., 2021).

Students, for their part, in the eagerness to fulfill the proposed tasks, in some cases with the teacher's guidance and in others autonomously executed their multimedia presentations, their permanent consultations through the publication of their work in blogs and the pedagogical use they gave to social networks such as Whatsapp and Facebook.   "Teachers have mostly opted for an asynchronous model accompanied by teacher-discussant interaction based on communication through e-mail, forums, or chat" (Pérez-López et al., 2021, p. 339). It is shown then that communication is a determining factor to avoid the isolation effect that usually occurs in distance learning models.   Cases presented in countries such as the United States through the donation of computer equipment and Internet cards to public school students showed that barely half of the students in the poorest counties - and with the highest percentages of undocumented immigrants - were attending online classes. In Mexico, through a digital newspaper publication, Nurit Martínez highlights the work of Higher Education Institutions such as the Universidad Autónoma Metropolitana (UAM) that donated 3,865 tablets equipped with internet cards to students in vulnerable conditions of access to technology and internet (Martínez, 2020).

A small part of the population is benefiting from these programs and have the possibility that online education will become the norm for the coming months or years, as well as it is also immediate to find new solutions and initiatives. "Some examples are the use of digital platforms to upload videos and documents by teachers and students, at times when they have internet. Another option, which is being used by some intercultural universities, is the

creation of forums in WhatsApp and Facebook that can be accessed from cell phones" (Lloyd, 2020, p. 119).

3. Metodology

3.1 3.1 Data Collection

The population considered for this research was 9980 students from the four faculties (Engineering, Political and Administrative Sciences, Health Sciences and Education Sciences) of the UNACH. This tabulated information shows that it is a national reality since it can be seen in Table 1 that UNACH students belong to the 24 provinces of Ecuador.

The research design is non-experimental, transactional, descriptive and descriptive from a quantitative approach to diagnose the percentage of connectivity, type of service, in reference to access to technological devices that university students have. The focus of the study was quantitative and the scope of the research was descriptive, since the aim was to determine the percentage of access to ICTs of university students in the family context in times of confinement.

	Nº	%
Gender		
Femenine	5640	56
Masculine	4340	44
Other	0	0
Total	9890	100%
Province		
AZUAY	31	0,3%
BOLIVAR	378	3,8%
CAÑAR	131	1,3%
CARCHI	94	0,9%
CHIMBORAZO	5837	58,4%
COTOPAXI	394	3,9%
EL ORO	78	0,8%
ESMERALDAS	67	0,7%
GALAPAGOS	16	0,2%
GUAYAS	58	0,6%
IMBABURA	170	1,7%
LOJA	100	1,0%
LOS RIOS	32	0,3%
MANABI	29	0,3%
MORONA SANTIAGO	202	2,0%
NAPO	180	1,8%
ORELLANA	99	1,0%
PASTAZA	214	2,1%
PICHINCHA	503	5,0%
SANTA ELENA	9	0,1%
SANTO DOMINGO DE LOS TSACHILAS	230	2,3%
SUCUMBIOS	126	1,3%
TUNGURAHUA	952	9,5%
ZAMORA CHINCHIPE	50	0,5%
TOTAL	9980	100%

Table 1. UNACH student data collection - Gender and Province of residence.

Data collection was carried out using the survey technique and a questionnaire was used as an instrument. A sample was not selected, since the study is descriptive, so we worked with the entire population. The data were obtained in the month of April 2020, that is, at the beginning of the academic period May - October 2020 and for their processing a filtering was performed using tables and Excel spreadsheets, descriptive statistics were used and bar graphs were used to describe each of the results obtained from each of the questions of the questionnaire applied.

4. Results and Discussion
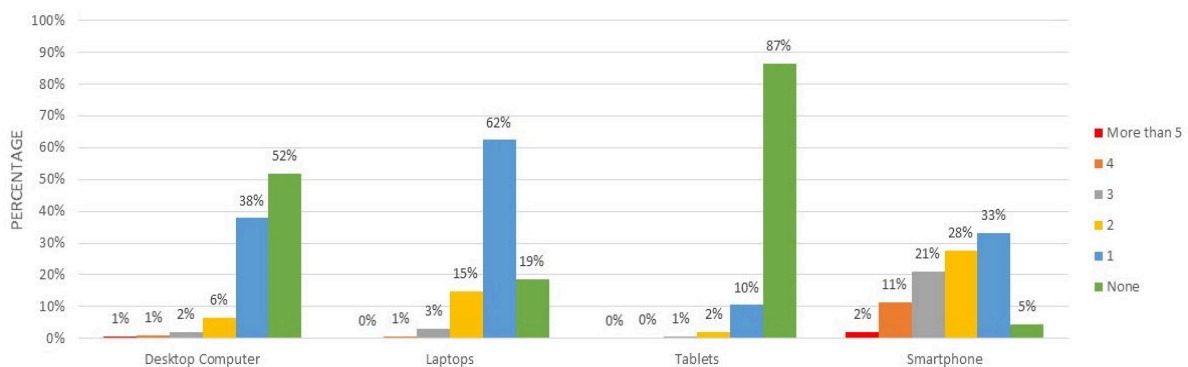
Figure 2. Student access devices

Smartphones between 1 and 4 devices with 95%, laptops between 1 and 2 devices with 80% and desktop computers between 1 and 2 devices with 46% are the percentages that UNACH students used for their academic work (Figure 2); it can be seen at first glance that there has been a variety of devices and equipment; however, the interpretation is different, since within the home the reality has forced the exchange with other family members as seen in Figure 3, therefore it is analyzed that only 62% of laptops, 38% of desktop computers and 33% of smartphones were probably exclusive to perform such activities.

It is evident that conducting ICT-mediated classes has not been an easy task, especially because it has been implemented with very little preparation time and in advance. The organization within each household was a fundamental point to exchange those devices and equipment according to the needs of each member, and not only for the academic issue, but also for the telework of their parents or relatives. All this experience has been an opportunity for both teachers and students to explore the different tools that information and communication technologies can offer them. Using podcasts, YouTube, digital resources from publishing houses, radio and television programming, flexible self-learning guides and thus maintaining certain levels of interaction, in addition to not lowering the level of educational quality (Chirinos et al., 2020).

These devices had to adapt to the consequent need for activities that were developed in both synchronous and asynchronous classes, with the participation of forums, or WhatsApp and Facebook groups, and of course access from cell phones was indispensable. In most of the homes of UNACH students use between 4 people or more the same internet connection giving as a consequence through this data obtained that family members alternate the use of the devices, and in turn considering the previous analysis in which it was pointed out that they use the devices both laptop and desktop computers (Figure 2). This implies a very serious and determining disadvantage at the time of fulfilling synchronous tasks.
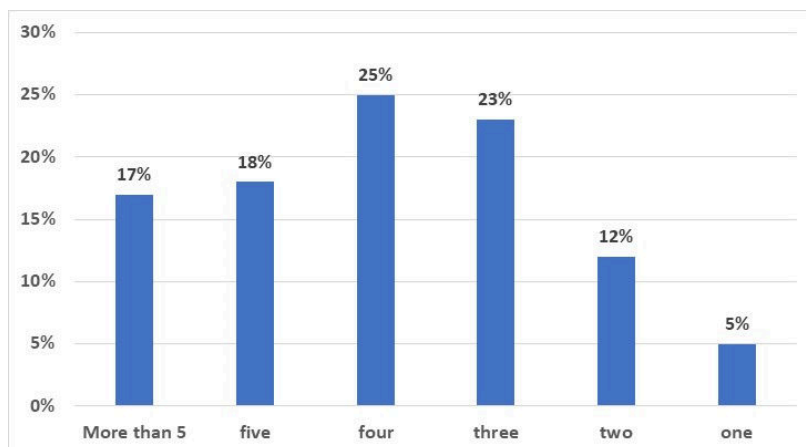
Figure 3. Number of people using the Internet at home at the same time.

For most, their first experience with virtual education came with confinement due to the pandemic. Likewise, this research has opened up other fundamental points such as inquiring about "other inequalities that have been exacerbated by the health and economic crisis in the world, including shortages of money and food due to layoffs in their odd jobs; the demands of caring for children and other family members; increased housework, etc." (Lloyd, 2020, p. 120).
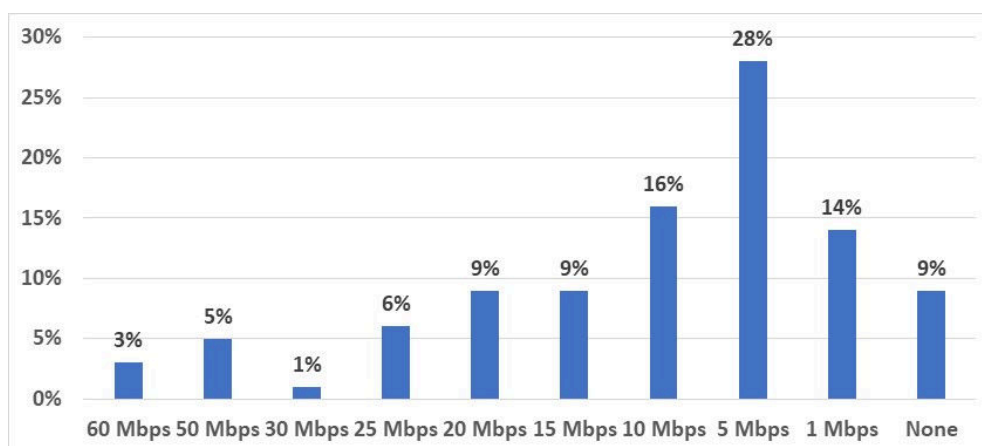
Figure 4. Speed of Internet service among students.

Once known the percentage of internet speed that each one of the students of the Universidad Nacional de Chimborazo has, it is determined that most of them do not have an optimal performance in connectivity since all family members are running different activities simultaneously, which affects the development of the proposed tasks and works.

Such demands affect those who have less economic possibilities due to the cost of hiring a fiber optic service, also within a little analyzed aspect is that of female students of all socioeconomic levels, since they have assumed a much greater burden of work at home during the contingency, which necessarily impacts on their level of academic productivity.
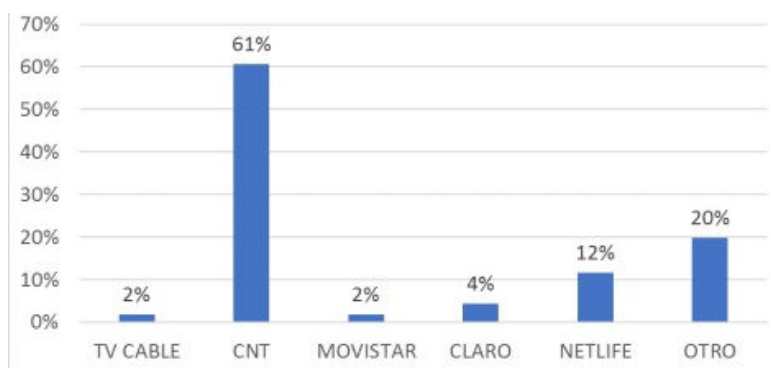
Figure 5. Internet providers for students

During this period of confinement due to the pandemic, the growth of telecommunications services accelerated, where 70.7% of the population in Ecuador used the Internet, which represented 11.5 percentage points more than in 2019. In rural areas it grew 14% and in urban areas, 10.4%. Of the total number of users, 92.1% used the Internet once a day. Also, the number of activated smartphones grew from 59.9% to 62.9% (El Comercio, 2021).

In the study, it is observed that the inconveniences are presented by having a service that has deficiencies along many geographical points of the city, province and country, since many students live in rural sectors. In addition, it is also confirmed through this data analysis that there are students who make balance recharges on their smartphones to connect to synchronous classes, which is not a guarantee of efficiency in their use and development of autonomous online activities.

5. Conclusions

The data obtained were filtered based on 3 important aspects such as the type of devices, and the number of devices that the surveyed students had, which in the end allowed us to know that approximately 70% of them share their devices with other family members. These analyzed data reveal the reality of most of the homes of university students, who during the time of confinement have had to look for ways and means to be able to fulfill their academic work. These difficulties presented as for example the internet connection, forces to consider a type of variants that can help and combine the activity developed with online education, and that is propitious to execute another research to determine if it was the factor that many students took at the end of the semester as an option of withdrawal in properly experimental subjects.

By showing these realities we can verify that students do not have electronic devices, likewise they do not have computers that allow them to work in academic activities during long periods of synchronous classes, it can also be observed that 25% have not made use of any type of device or equipment (Figure 2) in their academic activities, which is also worrisome.

Finally, the data indicate that internet is very necessary in homes as a basic service, so families in their homes have required the installation of internet being CNT the most requested (Figure 5), although this operator presents problems in the quality of service due to the intermittency for a long time (La Hora, 2021), which causes the continuous abandonment of synchronous sessions (Figure 6).

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Quality Assurance Systems: a tool for the continuous improvement of training programs, centers and universities

Sistemas de Aseguramiento de la Calidad: herramienta para la mejora continua de los programas formativos, centros y universidad

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Abstract

The University of Deusto has defined and implemented in its faculties a Quality Assurance System that covers all undergraduate, master's and doctoral degrees, as well as the management of the activities carried out in all faculties as a whole. The Quality Assurance System is implemented through the systematization of the continuous improvement methodology, by measuring and analyzing the satisfaction of stakeholders and the results of its processes. To broaden the scope of the system, a Global Quality Management System has been defined to achieve student satisfaction, from their first contact with the university world, to their insertion as graduates in the labor market. This system is based on the philosophy of process management. The Global Quality Management System is deployed in the Centers, Functional Areas and Services involved in the life of the university community. The system includes the Institutional Accreditation of the Faculties and the Quality Certifications according to the UNE-EN ISO 9001:2015 standard, in the following Functional Areas and Services: New Students, Library, Hall of Residence and Employment Service.

Keywords

Quality, tool, systematic, improvement, sustainability.

Resumen

La Universidad de Deusto tiene definido e implantado en sus facultades un Sistema de Aseguramiento de la Calidad que abarca todas las titulaciones de grado, máster y doctorado, así como la gestión de las actividades que se desarrollan en todas las facultades en su conjunto. El Sistema de Aseguramiento de la Calidad se implanta a través de la sistematización de la metodología de mejora continua, mediante la medición y análisis de la satisfacción de los grupos de interés y de los resultados de sus procesos. Para ampliar el alcance del sistema, se ha definido un Sistema de Gestión de Calidad Global para lograr la satisfacción de los estudiantes, desde su toma de contacto con el mundo universitario, hasta su inserción como egresados en el mercado laboral. Dicho sistema está basado en la filosofía de la gestión por procesos. El Sistema de Gestión de Calidad Global se despliega en los Centros, las Áreas Funcionales y los Servicios implicados en la vida de la comunidad universitaria. El sistema incluye la Acreditación Institucional de las Facultades y las Certificaciones de Calidad de acuerdo a la norma UNE-EN ISO 9001:2015, en las siguientes Áreas Funcionales y Servicios: Nuevos Estudiantes, Biblioteca, Colegio Mayor y Servicio de empleo.

Palabras clave

Calidad, herramienta, sistemática, mejora, sostenibilidad.

1. Introducción

Since 2007, the University of Deusto has defined and implemented a Quality Assurance System (QAS) for undergraduate, master's and doctoral degrees, in accordance with the AUDIT program guidelines defined by ANECA. This system is subject to a process of continuous improvement through the measurement and analysis of the satisfaction of stakeholders, the analysis of the results of its processes, audits and their review. The aim is to ensure that all our degrees respond as effectively and efficiently as possible to the current and future expectations and needs of our stakeholders, in the context in which our university is located and adapt quickly to changes in the context.

To broaden the scope of the Quality System, the University of Deusto has defined a Global Quality Management System. This System aims to emphasize and achieve the satisfaction of the essential piece of our university, which is the student. The objective is to improve student satisfaction from their first contact with the university world in secondary schools, until their insertion as graduates in the labor market. The Global Quality Management System follows the guidelines of the AUDIT program of ANECA in the Faculties for undergraduate, master's and doctoral degrees and the ISO 9001:2015 standard for the Functional Areas and Services of the University more directly related to our main interest group which are the students.

The criteria of ANECA's AUDIT program are summarized below:

- **How the Center defines its quality policy and objectives.** The Center must consolidate a quality culture supported by a quality policy and objectives known and publicly accessible, as a commitment to quality assurance (ANECA, 2018, p. 4).
- **How the Center guarantees the quality of its training programs.** The Center must have mechanisms that allow it to maintain and renew its training offer, developing methodologies for the design, approval, control and periodic review (internal and external), of the programs (ANECA, 2018, p. 5)..

- **How the Center orients its teaching to students.** The Center must be equipped with procedures that allow it to verify that the actions it undertakes are fundamentally aimed at favoring student learning and their access to the rules that regulate all phases of the formative process, from their admission, acquisition of competencies and skills, to the certification of the acquired learning outcomes (ANECA, 2018, p. 7).
- **How the University and/or Center guarantees and improves the quality of its academic personnel**. The University and/or Center, must have mechanisms that ensure that the access, management, development and training of its academic and teaching support staff, is carried out with the due guarantees so that it fulfills its own functions (ANECA, 2018, p. 9).
- **How the University and/or Center manages and improves its resources and services.** The University and/or Center must equip itself with mechanisms that allow it to design, manage and improve student support services, as well as the human and material resources necessary to facilitate an adequate development of their learning (ANECA, 2018, p. 10).
- **How the Center analyzes and takes into account the information of the results obtained by the Internal Quality Assurance System processes.** The Center must be equipped with procedures that allow it to measure, analyze and use the results generated by the Internal Quality Assurance System, among others, of learning, the satisfaction of the different stakeholders and job placement/employability, for decision-making that leads to an improvement in the quality of the teaching it provides and the rest of the activities it carries out (ANECA, 2018, p. 11).
- **How the University publishes information on degrees and other activities carried out.** The University and/or the Center must have mechanisms that allow it to guarantee the publication and periodic dissemination of reliable, updated and accessible information related to the degrees offered and their results, as well as other activities carried out therein (ANECA, 2018, p. 12**).**
- **How the Center guarantees the maintenance and updating of the Internal Quality Assurance System.** The Center must have a working methodology and the necessary resources to design and implement an Internal Quality Assurance System that effectively helps the achievement and improvement of its results, and enables its external evaluation on a regular basis (ANECA, 2018, p. 14).

2.2 Continuous improvement system. Basic pillar

One of the main pillars of the Quality Assurance System consists of the implementation of the continuous improvement system following the PDCA Cycle (Zaballa, 2000), as shown in Figure 1.
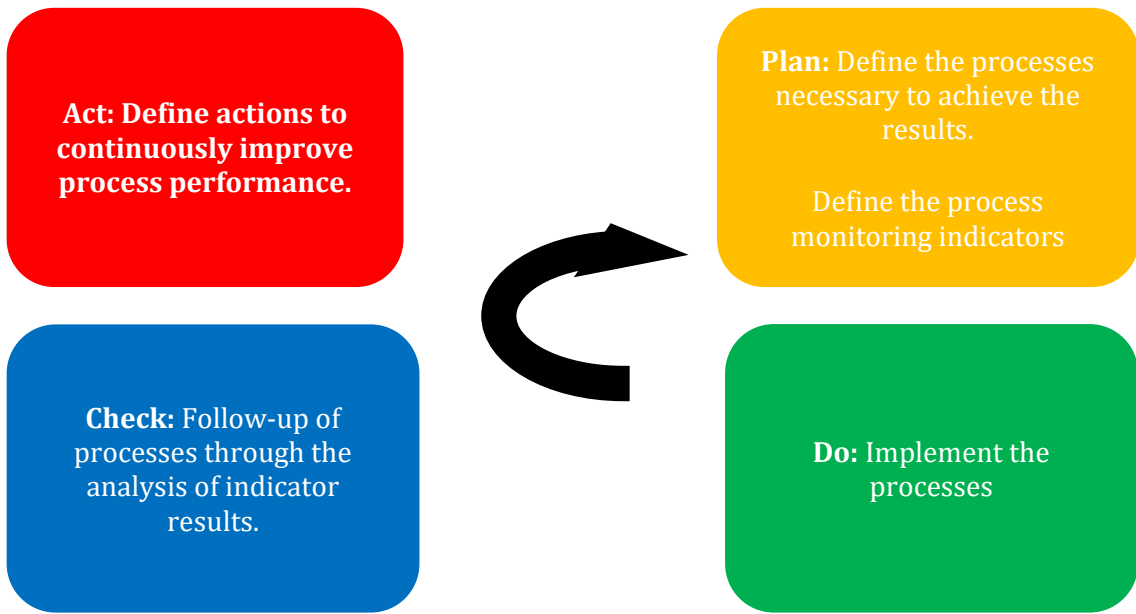
Figure 1. PDCA Cycle

2.1 Fase Plan

The planning phase consists of defining the processes necessary to comply with the guidelines of ANECA's AUDIT program and to achieve the planned results through their implementation. These processes are represented in a process map, whose deployment allows us to ensure the continuous and sustainable improvement of our University, our Centers and our degrees. It also helps us to comply with European and ministerial guidelines regarding the official nature of the degrees.

Below is an image of the map of processes of the Faculties of the University of Deusto (Figure 2.).
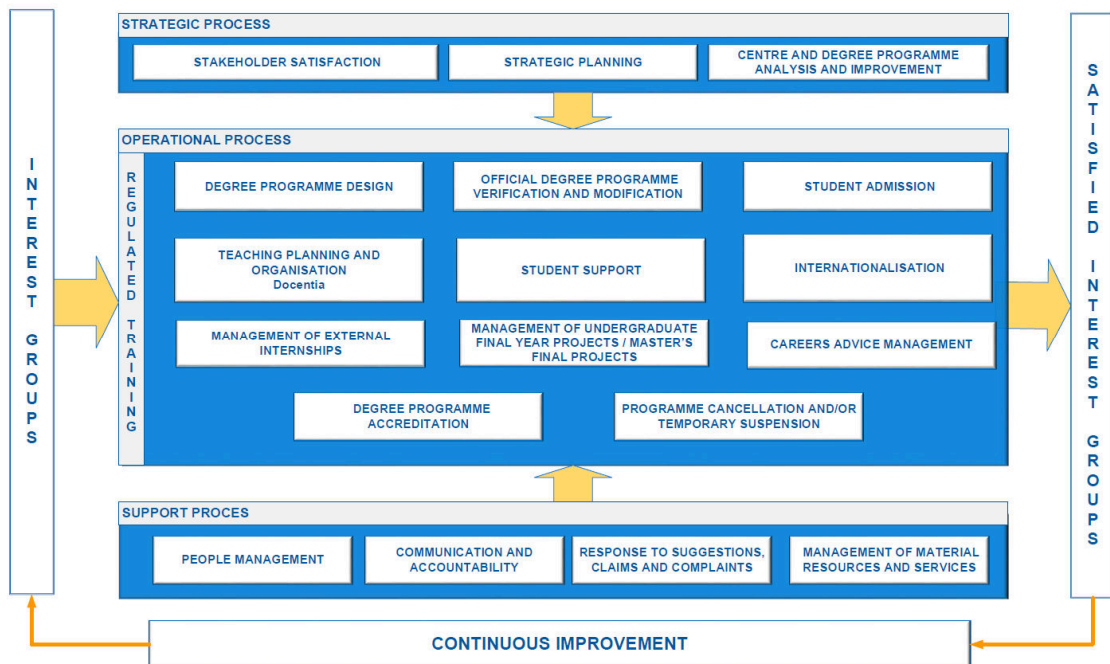
Figure 2. Process map

Likewise, in this planning phase it is very important to define the process monitoring indicators and the goals to be achieved for each indicator, in order to achieve the planned results.

2.2 Fase Do

The execution phase consists of implementing the processes planned in the previous phase.

2.3 Fase Check

The verification phase consists of monitoring the processes through the analysis of the planned indicators to check whether the goals defined in the planning phase have been achieved with respect to the process indicators.

2.4 Fase Act

The action phase consists of defining the actions necessary to continuously improve the performance of the processes. Based on the results of the previous phase, a series of improvement actions are identified and must be planned for implementation.

3. Cycle of continuous improvement of the academic program and the faculties

The academic programs of our university, throughout their academic life, from their design to their implementation, accreditation, reaccreditation, walk in a single direction, which forces them to a permanent review and as a result of this to the continuous improvement of all academic programs, as described in the Royal Decree 822/2021.

This system of continuous improvement extends to the faculties and the university, through the processes that are aligned with the AUDIT guidelines. The following figure represents the continuous improvement cycle followed by the academic programs and faculties in our University.
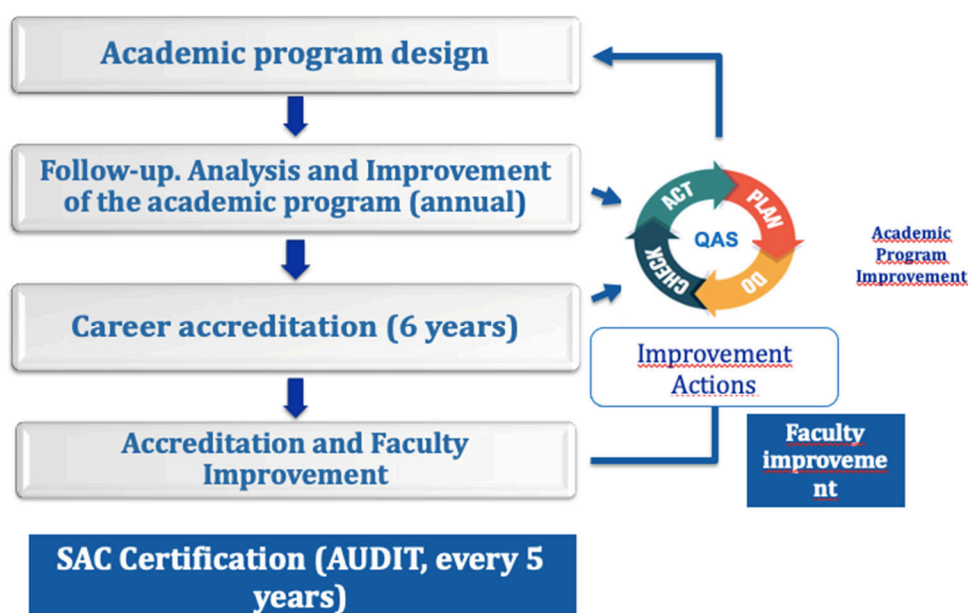
Figure 3. Continuous improvement cycle

3.1. Academic program design

In this process, proposals are prepared for official university academic programs designed in accordance with the European Higher Education Area. The following sections are defined:

- Description of the title.
- Justification.
- Objectives and competencies.
- Admission of students.
- Teaching planning.
- Academic staff.
- Planned resources.
- Quality assurance system.
- Implementation calendar.

3.2 Follow-up, analysis and improvement of the academic program (annual)

According to what is described in the guides "Guía de Apoyo para el proceso de seguimiento de títulos oficiales de Grado y Máster" and "Guía de Apoyo para el proceso de seguimiento de títulos oficiales de Doctorado" (ANECA, 2016, 2020), each academic program is monitored annually, i.e. how the program is developing annually according to certain criteria.

As explained in the publication of Zaballa (2018), at the University of Deusto we have implemented the strategic process called "Analysis and improvement of the Degree", which is carried out by the Quality Committee of each Degree. Said Commission is made up of the following members.:

- The person in charge of the degree.
- Representatives of the PDI.
- PAS representatives.
- Student representatives.
- Representatives of graduate students.
- Employers' representatives.
- Faculty Quality Manager.
- Representatives of the Quality Unit of the University of Deusto.

The mission of the Quality Committee of the Degree consists, in a first phase, in carrying out an exhaustive annual analysis of the results of the strategic process called "Stakeholder Satisfaction" (Zaballa and Liñero, 2017). With regard to this process, it should be noted that it is used to gather information on the needs and expectations of our stakeholders.

The University of Deusto understands a stakeholder as any person, group or institution that has an interest in the University, in the teachings or in the results obtained. These include at least students, professors, administrative and service staff, parents, public administrations, employers and society in general.

The "Stakeholder Satisfaction" process establishes the mechanisms to be applied to know, analyze and evaluate the degree of satisfaction of our students, their families, graduates, employers, PDI and PAS, with respect to the fulfillment of their needs and expectations. In this way, the necessary information will be obtained to apply continuous improvement to all activities and processes included in the Quality Assurance System. This process allows the collection and analysis of information related, among other aspects, to:

- Quality of teaching and faculty.
- External internships and mobility programs.
- Labor market insertion of graduates.

- Satisfaction with the training received.
- Satisfaction of the different interest groups.

This collection of information is done in several ways: satisfaction measurement surveys, focus groups and meetings with student representatives.

The stakeholder satisfaction process begins with the planning of the measurements to be carried out during the academic year. For this purpose, the objectives of the measurement are established, which will allow defining the characteristics and scope of the measurement. In addition, the population, the invited sample and the mode of measurement are also determined: survey (personal, telephone, mail, mail or fax), complaints or suggestions, contacts with students, etc. It is also necessary to establish the criteria for analyzing the results, the person responsible for carrying out the measurement and the deadline for its completion.

Based on the established planning, the University Quality Unit designs the support material that will be necessary to carry out the measurements. It is important to take into account that such material must be adapted to the defined measurement objective, the segment of students to be measured, the response time to be established and the subsequent processing of the data.

Once the measurement has been carried out and its results have been collected, the Quality Unit analyzes them, according to the criteria established in the initial planning. If the planned sample size is not obtained, it will assess in each case whether it is appropriate to extend the measurement period or whether the results obtained up to that moment will be analyzed. With the results obtained, it prepares a report measuring student satisfaction, which generally includes aspects such as the evaluation of results with quantifiable data, a retrospective comparison of data and the strong points and areas for improvement. The Quality Unit sends this report to those responsible for the degrees and the Center.

Likewise, the Quality Commission of the Degree analyzes the results of the support process called "Attention to suggestions and complaints", of the available public information, of the teaching activity and of the indicators established for all our processes. This committee also analyzes the improvement actions implemented, the academic rates obtained, the weak points detected and the monitoring report of the previous academic year. Once the analysis of all the information related to the Degree has been made, the Quality Commission of the Degree will obtain as a result the revised and updated public information available, the recommendations pointed out by the agencies and the analysis of the academic rates. In addition, the strengths and weaknesses of the degree in question will be extracted.

Based on the strengths and weaknesses found in relation to the Degree, the Quality Committee of the Degree will follow the guidelines described in the strategic process called "Improvement Actions" of our Quality Management System. In this process, the Quality Committee of the Degree must carry out a rigorous analysis to detect the main causes that have led to the origin of the weaknesses that have arisen in the Degree. Once the causes have been detected, the Quality Committee of the Degree must establish the most appropriate improvement actions to remedy the weaknesses and submit our Degrees to a process of continuous improvement.

The steps to be carried out by those responsible for the Degrees consist of making a description of the action or actions proposed to solve the weakness in question and appointing the person or persons responsible for carrying out the proposed action or actions. Those responsible for the degrees will also have to define the deadline or deadlines to be set for the execution of these actions and the parameter by which the effectiveness of the improvement action or actions implemented will be assessed.

Likewise, there is a Degree Monitoring Committee at the University level, whose main objective is to review the results of the analysis and improvement of each of our training programs. This review ensures the rigorousness of the results and compliance with the requirements set internally by the University, as well as with the external requirements demanded by quality agencies, other organizations and interest groups.

The Monitoring Committee acts once the process of analysis and improvement of all the degrees has been completed and before the results are taken to the Center's Quality Committee for analysis. In the event that the Monitoring Committee observes any type of incident, it will communicate it to the person in charge of the Degree so that the Committee can deal with it and act accordingly.

3.3. Degree accreditation (6 years)

The accreditation of degrees is developed according to what is described in the "Guía de Autoevaluación. ACREDITA DOCTORADO Program" and in the "Framework Document: Evaluation for the renewal of the accreditation of official Bachelor's and Master's degrees" (ANECA, 2018, 2019). The purpose of accreditation is to check whether the degree outcomes, among which are the learning outcomes, are adequate and allow guaranteeing the adequate continuity of the delivery of the program until the next renewal of accreditation (Figure 4. Evaluation criteria of the Acredita Program). It is carried out every six years for bachelor's and master's degrees on a mandatory basis.

Dimension 1. Management of the Degree

    Criterion 1. Organization and Development

    Criterion 2. Information and Transparency

    Criterion 3. Quality Assurance System

Dimensión 2. Resources

    Criterion 4. Academic Staff

    Criterion 5. Support staff, material resources and services

Dimensión 3. Results

    Criterion 6. Learning Outcomes

    Criterion 7. Satisfaction and Performance Indicators

Figure 4: Acredita Program Evaluation Criteria

For this purpose, the Quality Committee of the Degree evaluates the achievement of the learning outcomes of the degree, according to what was planned in the verified memory and thus ensure continuous improvement. For this purpose, the Quality Committee of the Degree analyzes the following aspects:

- The implementation of the curriculum and the organization of the program are coherent with the profile of competencies, objectives and planned learning outcomes.
- The degree has teaching coordination mechanisms that allow both an adequate allocation of student workload and an adequate time planning, ensuring the acquisition of learning outcomes.

- Students enrolled in the degree have timely access to relevant information on the curriculum and the planned learning outcomes.
- The Quality Assurance System implemented and periodically reviewed ensures the continuous collection and analysis of information and results relevant to the effective management of the degree, especially learning outcomes and stakeholder satisfaction.
- The support staff, material resources and services made available for the development of the degree are adequate according to the nature and modality of the degree, the number of students enrolled and the competences to be acquired by them.
- In the case that the degree contemplates the realization of external internships, these have been planned as planned and are adequate for the acquisition of the learning outcomes of the degree.
- The training activities, their teaching methodologies and the evaluation systems used are adequate and reasonably adjusted to the objective of acquiring the expected learning outcomes.
- The learning outcomes achieved satisfy the objectives of the training program and are appropriate to their level in the MECES.
- The defined graduate profile (and its deployment in competences and learning outcomes in the curriculum) maintains its relevance and is updated according to the requirements of its academic, scientific and professional field.

3.4. Faculty analysis and improvement process

The process of analysis and improvement of the Faculty follows what is described in the "Guide for institutional accreditation" (ANECA, 2018) and aims to incorporate continuous improvement to the center and its degrees, for which a transversal analysis of the center and its degrees is performed. To this end, there is a Center Quality Committee in which all the stakeholders of the Faculty are represented (Figure 5. Members of the Center Quality Committee.).

Figure 5: Members of the Center's Quality Assurance Committe

This Commission carries out the analysis of:

- Adequacy and effectiveness of the faculty's quality policy and objectives set based on it.
- Stakeholders (suggestions/complaints and satisfaction surveys to stakeholders).
- Results of the processes of the Faculty's Quality Assurance System.
- Status of the improvement actions of the Faculty and its Degrees.
- Recommendations of the Agencies (feedback from Unibasq to the reports of Analysis and improvement of the previous year).).

Once the aforementioned information has been analyzed, the Quality Committee of the Center will obtain as results the strengths and weaknesses of the Faculty and the results of the process of analysis and improvement of the degrees reviewed and approved. The Quality Commission of the Center is also responsible for adding or eliminating that information from the analysis of the degrees that it considers necessary.

3.5. Improvement actions process

The weaknesses detected in the previous processes constitute the Improvement Plan for each academic program and the faculty. For each area of improvement identified, concrete actions must be defined to achieve the desired objectives. The management of the Improvement Plan is carried out following what is described in the strategic process "Improvement Actions". This involves detailed planning of the specific actions to be carried out, the persons responsible for carrying out each planned activity, the deadlines defined for carrying out the actions and the effectiveness parameter of the improvement action or actions implemented. The actions are carried out within the established deadlines and their implementation is monitored up to the evaluation of the effectiveness of the actions carried out. Thus, we ensure that the improvement actions are implemented, are effective for the established purpose and do not remain good intentions.

4. Benefits of the Quality Assurance System

The Quality Assurance System has helped us to sustainably introduce the culture of quality and continuous improvement in the University and has become an effective tool for the systematic implementation of continuous improvement in the training programs, the Centers and the University.

With respect to the academic programs, it has allowed us to strengthen the system of:

- Collection of process information about the academic program.
- Analysis of the results obtained for decision making.
- Management of the balanced scorecard of the academic program.
- Definition of actions to improve the academic programs to adapt them to the needs of the labor market.

Likewise, we have been able to systematically improve our academic and service processes through evaluation and review.:

- The quality of the teaching provided and of the teaching staff.
- External internships and mobility.
- Satisfaction with the training received and job placement.
- Learning results.
- Attention to suggestions and complaints and the satisfaction of all groups involved and the communication of the results.
- Finally, it has facilitated the accreditation of academic programs, since the processes are developed throughout the life cycle of an academic program, which provides the collection and analysis of the results of the program for decision making and definition of improvement plans, all in a systematic way. This information is aligned

with the needs to accredit the academic programs, so that when it has to be accredited, the Quality Assurance System has been providing us annually with significant information and data for the definition of improvement plans throughout the life of the program. The necessary data for the accreditation process of a program are available to us from the first year of implementation of the program through the processes of the Quality Assurance System. In other words, we do not have to start collecting data on the program when we decide to accredit it..

5. Conclusions

The Quality Assurance System is a useful tool to implement continuous improvement in our degrees, our faculties, services and the university through an effective and systematic management of its processes. It is incorporated into the day-to-day dynamics of the university and is increasingly internalized in the stakeholders.

It must be flexible, adapt to changes and facilitate the constitution of dynamic, flexible, innovative and quality universities. It facilitates the accreditation of degrees, the evaluation and improvement of teaching, internships, mobility, job placement, the degree of satisfaction of our stakeholders, the implementation of competency-based teaching, etc.

The Quality Assurance System allows us to achieve student satisfaction from their first contact with the university world to their insertion as graduates in the labor market, and to sustainably improve the degree of satisfaction of our stakeholders with respect to their needs and expectations. It is important and vital that the Quality Assurance System is adapted to the needs of each university and each context, respecting the autonomy of the university and its institutional guidelines.

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Challenges of virtual education in Latin América

Desafíos de la educación virtual en Latinoamérica

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Abstract

The purpose of this article is to show and exhibit the challenges of virtual education in Latin America as a result of the advances in communication and information technologies that are currently being deployed internationally, and which were also accelerated after the COVID-19 pandemic. It was known that virtual education would lead to a change in the teaching and learning processes, but not in the way it prevailed, where it was revealed in all its contextualization, since it was characterized by the abandonment in the accompaniment and tutoring of students. In Latin America, education was transfigured from the institutions to the students' homes, leading to mostly negative rather than positive educational experiences for a large number of students at all school levels. This was due to the great social inequality prevailing in Latin America, creating a new social categorization, such as the inforricos and the infopobres. In other words, between those who can and cannot access virtual education. The above, showed again the great social, economic and educational differences that still exist in Latin America. Finally, this unfortunately does not favor people's literacy, nor does it favor the universal right to education.

Keywords

Social inequality, education, virtual education, poverty.

Resumen

Este artículo tiene como intención manifestar y exhibir los retos de la educación virtual en Latinoamérica producto de los adelantos en las tecnologías de comunicación e información que hoy en día se despliegan internacionalmente, y que además se vieron acelerados tras la pandemia del covid-19. Se conocía, que la educación virtual conllevaría un cambio en los

procesos de enseñanza y aprendizaje, pero no de esta manera que predominó, donde se reveló en toda su contextualización, ya que se caracterizó por el abandono en el acompañamiento y tutelaje de los estudiantes. En América Latina la educación se transfiguró de las instituciones a los hogares de los estudiantes, conllevando experiencias educativas mayormente negativas más que positivas para una gran cantidad de estudiantes de todos los niveles escolares. Esto se debió a la gran desigualdad social prevaleciente en Latinoamérica, creando una nueva categorización social, como son los inforricos y los infopobres. En otras palabras, entre los que pueden acceder y no a la educación virtual. Lo anterior, mostró nuevamente las grandes diferencias sociales, económicas y de educación que aún existen en América Latina. Por último, esto no favorece desafortunadamente a la alfabetización de las personas, como tampoco al derecho universal de la educación.

Palabras clave
Desigualdad social, educación, educación virtual, pobreza.

1. Introduction

The purpose of this article is to demonstrate and expose the challenges of virtual education in Latin America as a result of the advances in communication and information technologies that are currently being shown at the international level, and that are also generated by the effects of globalization, and that today, after the covid-19 pandemic, have arrived as a revolution in education - bursting in - and generating substantial changes in the teaching and learning processes, both for teachers, students and administrative staff (Cantú-Martínez, 2021). In view of this, the role played by governmental bodies in the field of education, as well as private initiative, has been extremely relevant, as they have involved society in general in this abrupt change as the covid-19 pandemic progressed and technology itself progressed vertiginously in the face of the demand of all institutions in the education sector to incorporate these new technologies to continue providing access to education for large masses of students at different levels of preparation.

In different Latin American countries, education moved from the institutions to the students' homes, as well as teachers and administrative workers moved their work and responsibilities to the privacy of their homes; evolving from face-to-face to distance education, and in other cases to blended learning. The use of the Internet became an ideal platform to transmit knowledge between people, and although this is still debatable particularly in the teaching-learning process and thus guarantee the competencies and skills of students, it was the most suitable response found in order to establish links in education and continue with the educational preparation of students.

On the other hand, this scenario revealed the structural deficiencies as inequalities existed in the educational systems and socioeconomic environment of the people. In this way, a large group of students throughout the Latin American region were left adrift because they did not have the capabilities and economic resources - which would make it possible - to incorporate the necessary equipment and infrastructure to maintain the continuity of their learning, remaining invisible before the education authorities and society itself.

Thus, education is distanced from the public function, since virtual education and those who promote it are very far from the precepts of synchronous and prescriptive functionality of the learning process that guarantees the competences that students must have in order to advance in their personal training and thus integrate into the labor social space. This paper also intends to offer a reflection -from the position of hermeneutic bioethics- on this event and to exhibit the challenges that virtual education poses together with its means in the way of building a human being, in an environment that is affecting the way of being, existing and thinking of the whole society in the world. And in which, in addition, there is still a digital

divide that will now define the distance between people who can access education and those who cannot do so for economic and cultural reasons and/or causes, thus creating new power structures defined around access to virtual education (Venegas and Green, 2018).

2. Development

In order to understand the social implications and challenges that arise for Latin American societies in terms of virtual education, it is necessary to clarify the panorama of its use and experience as an emerging medium during this COVID-19 pandemic, which far from being an added value that allowed access to educational content was transformed into educational experiences denied to a large volume of students. Therefore, it will delve into this topic and undertake a discursive line on the role of education, the reality in Latin America and the context of virtual education in the Latin American region.

2.1 Role of education in society

When taking up again the discourse on education, it becomes pertinent to consider with great attention the foundations of education. Essentially from the fruitful dialogue that must subsist between the mentor and the learner, which according to Paulo Freire allows to meditate the deliberate, and is circumscribed to the activity of instructing in the framework of the social contextualization in which it exists (Guichot, 2006). That is, as Mires (1996) commented, it is in the formation of educating people that the threads of dialectics and the complexity of reality are interwoven, where considerations emanate that may be unequal or in agreement among human beings. Thus, education - as a social instrument - is consigned to the development of people, fundamentally in three areas such as intellectual and moral capacity and the socialization of human beings according to the socio-cultural context in which they live. Thus, education is one of the factors that have the greatest impact on the progress of societies, that is, education is inescapable in every sense (OECD/ECLAC/CAF, 2016). In such a way, education is instituted as a means for the development of all people and additionally entails the transformation of society, in which it seeks to establish a solidarity of social order that characterizes its members.

For this reason, all the nations of the world recognize the right that every person has to education, which is stated in Article 26 of the "Universal Declaration of Human Rights" (United Nations, 1948) which states in points 1 and 2 the following:

> 1. Everyone has the right to education. Education shall be free, at least as regards elementary and fundamental instruction. Elementary instruction shall be compulsory. Technical and vocational education shall be made generally available; access to higher education shall be equal for all, on the basis of merit.

> 2. Education shall be directed to the full development of the human personality and to the strengthening of respect for human rights and fundamental freedoms; it shall foster understanding, tolerance and friendship.

From this configuration, education takes on a role of formation, enlightenment, interpretation and revelation for people, which allows them to be free, objective and impartial in their actions. That is, from a positivist perspective, the ultimate aim of education is to build a human being with the necessary qualities and competencies to face his future life and overcome obstacles with the intellectual and moral capacities required by the social environment (Durkheim, 1989). Particularity -which today- is also ratified in target number 4.3 of Sustainable Development Goal 4, which addresses the aspects of education, and which indicates that the number of people in the world with sufficient skills to integrate into

society, and thus have access to decent work, should be increased (United Nations, 2021). It has also inscribed that the socioeconomic progress of a society is based on the education of people, and thus makes it possible to reduce the social poverty in which a large number of people subsist. In this sense, Munari (1994) expressed since the nineties of the last century that education should be considered as an institution of the common good. His argument is based on the obligatory nature of education for all people, as well as on the fact that it should be provided free of charge, precepts that are articulated in equality and in the "Universal Declaration of Human Rights" promulgated in 1948.

2.2 Situation in Latin America

The conditions of living environments in Latin America show structural gaps characterized by the presence of different social crises, in which both equality and the sustainability of economies have been affected, delaying the possibility of people's access to a condition of general wellbeing. As a result, all Latin American nations face different and varied social, economic and environmental challenges, which show inequality, marginalization, poverty and social vulnerability. In this sense, the Economic Commission for Latin America and the Caribbean (ECLAC) (2021) expresses the following with reference to Latin America:

> COVID-19 reaches a region marked by a matrix of social inequality, whose structuring axes - socioeconomic stratum, gender, stage of the life cycle, ethnic-racial condition, territory, disability and migratory status, among others - generate scenarios of multiple and simultaneous exclusion and discrimination that result in greater vulnerability to the health, social and economic effects of this disease (p. 13).

All of the above adjacent to a prevailing malaise -of a general order- in Latin American countries in relation to public policies, which were usually accompanied by acts of protest and civil resistance, to plainly demand justice of a social nature. A situation that Cetrángolo and Curcio (2017) attributed to "inequality of opportunities at the beginning of life and during the education cycle, which in turn significantly impacts the possibilities of achieving higher levels of productivity, development and quality employment" (p. 7). This is projected, according to ECLAC (2021), in a very clear way during the period from 1990 to 2020 in Latin America, where extreme poverty increased from 7.8% to 11.3% -which represents 78 million people in extreme poverty- while the population in poverty increased in this same period from 27.8% to 30.5%, which represents 209 million people in this condition. This is equivalent -in the case of extreme poverty- to considering the Colombian and Venezuelan populations as a whole; while that represented by poverty would be similar to bringing together the entire population of the following countries: Argentina, Chile, Paraguay, Bolivia, Peru, Ecuador, Colombia and Venezuela. Thus, Blanco (2006) states that the Latin American region is "characterized by very disintegrated and fragmented societies due to the persistence of poverty and the great inequality in income distribution, which generates high levels of exclusion" (p. 1). This has also implied that the current situation of education in the Latin American region lags behind the global demands for building people with competencies and skills to integrate into the prevailing modernity of society. In this context, the aforementioned denotes an extremely complex scheme for Latin American countries, since the requirements in terms of educational preparation are not met, while education policies also become dissonant with the prevailing social context in the world and in their national circumstances in a particular way (Martínez, 2009).

Consequently, De la Cruz (2017) asserts that the foundation of any policy - regional or national - must be essentially equitable and inclusive, and in this case the educational one, must provide the possibility for everyone to access a full life with dignity that allows them to build their life trajectory, as well as to make their own decisions in life. This situation is

highly questionable in the current regional scenario. Thus, the prevailing conditions hinder an inclusive education for all people, and where it is still ostensible to find large gaps in the quality of education provided.

2.2 Scenario of virtual education in Latin America

Education in general has been affected by the changes of modernity and the advance of information and communication technologies that have influenced the teaching and learning processes. However, this interest promoted in the discourse prior to the COVID-19 pandemic now raises many questions after the emergence of virtual education. What challenges exist in Latin America to introduce an inclusive and committed virtual education? What theoretical and methodological challenges are posed by this new virtual scenario? Will the virtual experiences left by the COVID-19 pandemic be considered or simply ignored? Is it possible to aspire to this virtual modality when in the context of the Latin American region there are still large structural social lags, and the quality of education is also uneven among members of the same society?

These questions and others arise today in the field of education, "at a time when political decisions require, more urgently than ever, pertinent and substantive knowledge about schooling, education, and the diversity of actors involved" (Gluz, Lima and Elías, 2020, p. 6). Undoubtedly, this emerges in the Latin American social context because educational institutions -contrary to their substantive purposes- ceased to be providers of the space to exercise egalitarian educational practices -very purposefully- and where the right to education was violated. In reflecting on the above, Gluz (2020) comments that the health crisis revealed an educational poverty of institutional order, where it was also ostensible an education with "specific and devalued services for vulnerable population groups, different from those accessed by privileged groups" (p. 15). Therefore, the structural deficiencies became more acute, which have their genesis in the previous economic and social crises, which have also persisted over time.

In this frame of reference, for all Latin American countries, it entailed problems of institutional order with a great number of contradictions, where the urgent transition towards the virtual generated eventualities, mainly of a financial nature due to the lack of adequate infrastructure. On the other hand, it created a crisis for both teachers and students, who did not have the skills or the capacity to transfer the activities - labor and academic - to their homes; nor was it evaluated that there was more than one member of the family studying and/or with different abilities (Cantú-Martínez, 2021). In other words: "The classroom was replaced by emergent spaces: bedroom, dining room, living room, study room or other similar spaces; social contact between classmates, friends or teachers was limited only to family contact" (Aguilar, 2020, p. 217). This highlighted the digital gaps as well as the socioeconomic gaps shown by the families of both teachers and students. And in particular, in the academic training of students will weigh negative consequences where it will be ostensible an even greater decline in educational quality -if it was available- by the implementation of virtual education, since -in our opinion and experience- it does not guarantee the appropriation of competencies, skills and abilities, being only of demonstrative order. This contradicts Freire's (1997) assumption that it is in practice that "knowledge is confirmed, modified or expanded" (p. 24).

But it was also clear how education professionals were not considered in this virtual education planning, giving in to the IT professionals who set themselves up as the ones who would - and did - set the course for the education of a whole country, even containing and ignoring the voices of educators completely. By turning teachers at all levels into simple repeaters of knowledge, and in other cases as simple actors and actresses of a staging called education, where any process to check whether the student was able to obtain a skill or information, which guarantees the transformation of this and allows him to advance in his

development as a social subject, is bypassed (Aguilar, 2020). It was known that virtual education would come to change the teaching and learning processes, but not in this way it burst in, where it manifested itself in all its expression, since it was characterized by the abandonment in the accompaniment and tutoring of students, not attending to the particular needs and problems of the students in the learning processes. It has also "lost with it, for example, the direct or real contact with people, socializing, the relationship that one has face to face and spontaneous feelings and expressions, absences that do not contribute to the human" (Sepúlveda-Romero, 2019, p. 100).

But, above all, the four fundamental elements for learning were completely ignored: "elements of the environment (sound, light, temperature and furniture), emotional elements (motivation, persistence, responsibility, structure), sociological and physical elements (perception potential, intake, time, mobility) these determine the ability, processing and retention of information, values, facts and concepts" (Castro and Guzmán de Castro, 2005, p. 86). As also, there was a silent disavowal, of the recognition of learning styles that may be present in students, such as the active, reflective, theoretical and pragmatic profile, as made known by Alonso, Gallegos and Honey (1994) and Cantú-Martínez and Rojas-Márquez (2018). Definitely, by these judgments that we have made known other education professionals, such as Nieto (2012) have critically pronounced and consider this virtual education a "computer and communicative paraphernalia as a substitute or substitute good" (p. 143), of obsolete characteristics that pretends to replace traditional education.

3. Final considerations

Currently in Latin America there is an education differentiated now by the mechanisms of virtualization and digitalization, as a result of the health contingency of COVID-19, where it has been found that a large part of society has been excluded from access to education, coming from sectors characterized by being humble and of scarce economic resources, with different expressions and particularities in each Latin American nation.

These common attributes shared by different population groups throughout Latin America, have given new visibility to the existing structural flaws in education, in which many people still subsist. In this way, the foundation pointed out by Simón Rodríguez of an education for all, whose argument holds that education is the support for building a more just and egalitarian society, is overturned (García, 2010). In addition, virtual education in the Latin American region is giving rise to a new social phenomenon - which, based on the particularities of these populations mentioned above - can be called computer illiteracy, as a result of the existing gap in accessing and knowing how to use this technology, and thus gaining access to public education for people with limited resources. This has created a new social categorization such as the inforrich and the infopoor, where the former is those who have access to the Internet and have the appropriate equipment, while the latter remain segregated from these technologies (Cantú-Martínez, 2021).

In addition to the above, there are still more questions that constitute debatable challenges to be overcome by virtual education for its correct implementation in Latin America, such as: Is teaching the same as the virtual demonstration of contents? Is learning virtually only cultivating contents of theoretical exposure? Does virtual education guarantee students' competencies? Do students in their immaturity glimpse that they are in a virtual education with collaborative and critical environments about knowledge? Does communication through educational virtuality surpass communication between people face to face? Does virtual education favor people's sociability? Does virtual education contribute to people's human rights? Does virtual education guarantee social sustainability? Is virtual education a

self-taught education? Or is virtual education another social artifice of power and political control?

Finally, let us make a deep, reserved and honest reflection: Does virtual education favor the benefit of people's literacy, as well as the universal right to education that every person in Latin America has?

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Didactic, technological and communicational considerations for EVEA design

Consideraciones didácticas, tecnológicas y comunicacionales para el diseño de un entorno virtual de enseñanza aprendizaje

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Abstract

In this research we determined the didactic, pedagogical, technological aspects as well as the learning methodologies which should be considered in order to develop an VTLE that guarantees a quality learning. For this purpose, we used the qualitative approach supported by the design of the grounded theory with the purpose of generating theories, concepts or hypotheses from the analysis of the interviewees' points of view and the contrast with the literature previously analyzed. In this sense, we interviewed 8 experts in the subject of design and implementation of VTLE and the data obtained were analyzed by means of the software ATLAS.TI 8, following the model of the emergent conception.

According to the results obtained, we determined that in order to design a VTLE the instructional design ADDIE should be used, the resources of the VTLE should be varied to assist the diversity of learning styles and the contents should be up-to-date, the activities should be focused to solve problems of the professional context of the students and they should promote the autonomous and collaborative learning, the andragogical foundations of the students must be also considered, and finally the use of the B-Learning approach and the Flipped Classroom methodology so that they use ICT tools to support the teaching and learning processes.

Keywords

Resumen

En la investigación determinamos los aspectos didácticos, pedagógicos, tecnológicos y metodologías de aprendizaje, que se consideran para desarrollar un Entorno Virtual de Enseñanza Aprendizaje (EVEA) a fin de garantizar un aprendizaje de calidad. Para ello utilizamos el enfoque cualitativo apoyado del diseño de la teoría fundamentada con el propósito de generar teorías, conceptos o hipótesis a partir del análisis de los puntos de vista de los entrevistados y el contraste con la literatura analizada previamente. En este sentido, entrevistamos a 8 expertos en la temática de diseño e implementación de EVEA y los datos obtenidos se analizaron mediante el software ATLAS.TI 8, siguiendo el modelo de la concepción emergente.

De acuerdo a los resultados obtenidos determinamos que para diseñar un EVEA se debe utilizar el modelo instruccional de Análisis, Diseño, Desarrollo, Implantación y Evaluación (ADDIE), los recursos del EVEA deben ser variados para atender a la diversidad de estilos de aprendizaje y sus contenidos deben ser actuales, las actividades deben estar enfocadas a resolver problemáticas del contexto profesional del estudiantado y deben fomentar el aprendizaje autónomo y colaborativo, se deben considerar los fundamentos andragógicos del estudiantado, y finalmente el uso del enfoque de aprendizaje híbrido (b-learning) y la metodología de la clase invertida (flipped classroom) de modo que utilicen las TIC como apoyo al proceso de enseñanza y aprendizaje, y se aproveche el tiempo de clase.

Palabras clave

entorno virtual de enseñanza aprendizaje, ADDIE, andragogía, Moodle, TIC.

1. Introduction

From the advent of the Internet to the present day, its growth has been massive. By the year 2020, 61% of the world's population has access to the Internet, and in Latin America its penetration reaches 71% of the population (Internet World Stats, 2020). As a consequence, there has been an easy access to a great amount of information and allowing direct communication from anywhere in the world.

In this sense, educational institutions cannot remain on the sidelines of its use, isolating themselves in obsolete and traditional educational practices. In the field of education, the Internet offers several possibilities, in this regard Tesouru and Puiggalí (2004) refer that it allows: a) providing information to strengthen students' knowledge; b) providing a wide variety of tools (simulators, games, videos, etc.), making the acquisition of knowledge more enjoyable.) making the acquisition of knowledge more enjoyable; c) provide numerous sources of information such as databases, academic search engines and articles for research work; d) allow the training process through courses found on the network; e) provide the possibility that the educational process is not face-to-face because it facilitates that students can participate in the development of the course anywhere, and; d) break the barriers of distance by facilitating synchronous and asynchronous communication with anyone no matter where they are. As we have observed, the incorporation of Information and Communication Technologies (hereinafter ICT) in the educational field has allowed for a new vision of the scenarios where the teaching and learning process takes place.

In this sense, the Virtual Teaching and Learning Environments (hereinafter EVEA), become an effective tool to favor the aspects mentioned above. Because they facilitate the development of the curriculum through content and training activities, in addition to encouraging participation and communication between its actors (students and teachers) synchronously and asynchronously, they allow student evaluation and the optimization of the teaching-learning process in any face-to-face, online, distance or blended learning

educational modality (Colina and Gutiérrez, 2013; Belloch, 2010; Salmerón, Rodríguez, and Gutiérrez, 2010; Salinas, 2012).

It is evident to observe how in the last decades online education has obtained a constant growth. Studies by Online Business School (OBS, 2014) state that, by 2019, about 50% of the world's higher education was delivered through E-Learning. Furthermore, according to the report 'Turning Point: Higher Education in Latin America and the Caribbean', published by the World Bank, e-learning has grown by 900% worldwide (WB, 2017).

However, in Latin America the situation is alarming. The Organization for Economic Cooperation and Development (OECD, 2015) in its studies determined that in Latin America only 19% of educational institutions focus on distance education or virtual education. Based on our context according to data obtained from the portal "Current offer of the Higher Education System" of the Higher Education Council (CES, 2020) of the 60 universities and polytechnic schools that exist in Ecuador, only 10 of them, i.e. 16.66% offer professional master's degree programs and non-medical specializations under the online modality. And of the 60 universities and polytechnic schools that exist in Ecuador, only 17 of them, i.e. 28.33%, offer third level degrees in the online modality. Aware of this problem, the research determined the didactic, technological and communicational aspects that are adequate for the design of an EVEA, as well as the instructional designs for the development of virtual platforms that allow guaranteeing quality learning, in order to be projected in virtual education.

The research is structured as follows: in section 2, the literature review and theoretical foundation related to the aspects to be considered for the design of EVEA are presented; in section 3, the approach, scope and design of the research are described, as well as the population and sample, techniques and instruments for data collection and the way in which they were analyzed; in section 4, we present the analysis and interpretation of the results obtained from the interviews applied to experts in the different areas; in section 5, we discuss the results by contrasting them with authors referring to the research topic; finally, in section 6, we describe the conclusions derived from the research process.

2 Literature review

2.1 Virtual teaching and learning environments (VLEE- EVEA)

Paz-Florio (2015) mentions that an EVEA "are computer platforms whose purpose is to guide pedagogical communication among participants involved in the educational process and create spaces or communities organized around learning" (p.1). In this sense, an EVEA is a virtual space designed to complement and strengthen the teaching and learning process through the integration of activities (autonomous and collaborative) and interactive resources developed through different web 2.0 and 3.0 technological tools. Among the most important features of EVEA we have:

- Provide participants with easy access to learning resources and activities.
- Allow greater flexibility in carrying out learning activities.
- Facilitate communication between teachers-students and students-students through synchronous and asynchronous communication tools.

2.2. Didactic aspects for the design of an EVEA

2.2.1. Instructional design

Belloch (2013) refers that "instructional design is focused on creating a learning environment and materials, clear and effective, that will help the student to develop the ability to solve specific tasks" (p.5). In this sense, we establish that instructional design refers to a scheme which involves the processes involved in the design, implementation and

evaluation of a learning environment with the objective of planning the training process, selecting the most appropriate tools and, more importantly, adapting the activities and resources to the needs of the students addressed by the course.

2.2.2. Instructional design models

For Belloch (2013) "Instructional Design Models serve as a guide for professionals, systematizing the process of developing training actions" (p.2). Thus, the instructional design model contains the description of the rules, roles, and resources to be used for the development of learning environments.

There are several instructional design models, such as the Gagné and Briggs model, the Dick and Care model, the ASSURE model, the ADDIE model, etc. However, for the development of the research, the ADDIE instructional model was chosen because it presents greater flexibility for the development of quality educational environments at the university level, and in recent years it has been used in the Faculty of Philosophy, Letters and Educational Sciences of the Universidad Central del Ecuador, where the research was conducted.

2.2.3. ADDIE instructional model

The ADDIE instructional model is a model that serves as a reference for the development of learning environments; its name is an acronym of its phases which are Analysis, Design, Development, Implementation and Evaluation; and its objective is to guide the student to the construction of knowledge in a learning space.

For Castillo (2009) the phases of the ADDIE model are based on a "systemic, efficient and effective methodology for the production of educational resources. The strength that the ADDIE Model has gained in recent years comes from the fact that it is assumed to be a generic model" (p.4). The following is a detailed description of each of its phases:
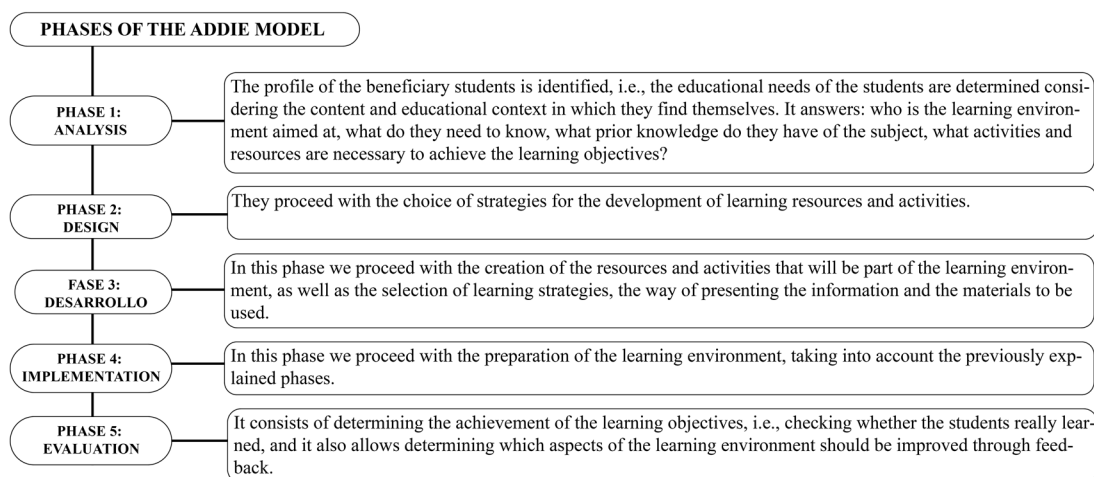
Figura 1. Fases del Modelo ADDIE

2.2.3. Design of digital activities

Online learning activities place the student in a much more active role than conventional learning activities, where the student plays a leading role and his participation is the key to success in his learning process. Cabero and Román (2006) refer to the fact that learning activities should help the student to understand, analyze, synthesize and evaluate the proposed contents with the objective of converting the raw information into a set of knowledge, skills and attitudes related to the subject being worked on. That is why the

design and selection of activities is one of the most important tasks and they should answer questions such as: Which activities are more meaningful, which activities are more usual or important according to the subject matter of the course, through which activities can the different capacities of the students be developed, which activities are better suited to the characteristics of the students, and which activities are more motivating.

In this sense, one way to classify activities is the use of Bloom's Taxonomy where activities are classified by knowledge, comprehension, application, analysis, synthesis and evaluation. Finally, among the aspects that should be considered for the design of activities, Cabero and Román (2006) state that the following should be considered:

> a) clearly specify the context and the environment where the activity will be carried out; b) determine the time limits for its realization and delivery; c) determine the form in which it will be sent; d) explain the resources that students may use for its realization; e) establish the number of students that may carry out the activity, as well as their mode of participation; f) explain what behaviors are considered desirable for the development of the activity; g) clearly establish the criteria for evaluating the execution of the activity, and; h) establish how the final product will be presented (writing, type of material, length, etc.) (p.40).

2.2.4. Design of digital educational resources

The use of EVEA in the educational context has gained much strength in recent years. It is therefore necessary to create, search for and select quality educational resources in accordance with the demand and the academic offer in its different modalities and that respond to previously defined quality standards. Thus, for a resource to be of quality, the following conditions must be met: a) the resource creator must have a very broad knowledge of the subject; b) teaching-learning objectives must be established with the purpose of delimiting content; c) an ICT resource must be chosen to present the resource; d) methodological procedures must be proposed that will allow the student to approach the object of study, and; e) the educational digital resources according to the desired level of cognitive development namely (Zapara, 2012). Referring to item e) it is convenient that:

- For the formation of concepts: resources should be used that allow the student to explore information with the purpose of expanding and acquiring knowledge about a topic of study.
- For understanding, association and consolidation of learning: it is important to use resources that allow interaction with the objective of understanding processes and integrating knowledge.

2.3. 2.3. Technological aspects for the design of an EVEA

2.3.1. ICT tools for the development of EVEA activities and resources with Moodle

ICT tools to develop learning activities with Moodle: the following is a description of the tools included in the Moodle platform for the development of activities and their use within an EVEA:

Activity	Definition	Use
Forum	• The forum is a virtual space for social and academic interaction in which one can argue and introduce interpretations of a specific topic.	• Promote critical thinking.
Chat	• It is a synchronous communication tool that consists of simultaneous conversation between two or more people connected to the network.	• Create spaces of opinion among several people where they can form a criterion on the topic discussed.
Videoconference	• A communication tool that allows synchronous communication between the teacher and the students.	• Generate ideas and arguments through collective dialogue on a specific topic to enrich knowledge.
Task	• A tool that allows planning, organizing and grading evidence requested for the development of an activity.	• Discuss, analyze collectively, ask questions to teachers or students and receive advice.
Questionnaire	• Evaluation tool that allows to design questionnaires in a very simple and flexible way.	• Construct and share information synchronously among several students to build new knowledge.
Wiki	• It is a web site that allows the construction of knowledge collectively with other users.	• Provide visual and audio explanations from experts to facilitate the understanding of the different topics of the course.

Table 1. Activities in Moodle

2.3.2. ICT tools to develop resources with Moodle:

The following is a description of the tools integrated in the Moodle platform for the development of resources:

Resource	Definition	Use
Archive	• Resource that allows you to attach text documents, images, videos and audios.	• Share support or study material.
Folder	• Tool that allows you to host different types of files.	• Organize information on a specific topic.
Url	• Tool that allows linking internal or external websites.	• Share different types of resources in an organized way.
Book	• Resource that allows presenting topics as a book, i.e. by chapters or subchapters.	• Create a portfolio of evidence.
Page	• Resource that allows inserting web pages within EVEA.	• Provide external links of interest.
Tag	• Resource that allows inserting any multimedia file or text inside the EVEA.	• Link resources found within EVEA.

Table 2. Resources in Moodle.

2.4. Autonomous learning

Autonomous learning is understood as the faculty that allows the student to regulate his or her own learning by making sound decisions (Monereo and Castelló, 1997).
Crispín (2011) refers to autonomous learning as a process where a person self-regulates his or her learning and becomes aware of his or her cognitive and socio-affective processes.
From the above definitions we determine that, in autonomous learning, the student establishes his or her own learning pace through the appropriation of learning strategies that allow him or her to articulate the knowledge.

2.5. Collaborative learning

Gunawardena, Lowe and Anderson (1997) refer to collaborative learning as a process in which each person learns more than he or she would learn on his or her own, through interaction with the members of the group. Thus, we can understand collaborative learning as a process where the student generates a more efficient construction of knowledge through interaction with his or her work group, the contrast of each member's point of view and the cooperation of its members.

It is important to mention that in learning "subjects work together", being possible the spontaneous division of labor, in addition to the fact that participation is horizontal and roles can change permanently, unlike cooperation, where the division of labor is "vertical"

and "fixed" (SUMMA, 2019). Collaborative learning is created when there is a well-defined interdependence among group members. Johnson and Johnson (1999) refer that some of the principles for collaborative learning are: collaboration, responsibility, communication, teamwork and self-evaluation. Each of the phases is detailed below, according to the aforementioned author.:

- Collaboration: support among the members of the group to acquire knowledge of the subject of study, at this stage all resources, achievements and goals are shared.
- Responsibility: each member of the group must be responsible for the percentage of work assigned. And all members must remain involved in the task of each member to support each other in times of difficulty.
- Communication: consists of sharing relevant information, supporting each other efficiently, providing feedback to optimize the work and analyzing the conclusions of each member in order to obtain better quality results.
- Teamwork: consists of solving problems together, developing organizational, planning, communication, leadership and problem-solving skills.
- Self-evaluation: each member of the group evaluates his or her performance individually and collectively, in order to rectify errors and improve work dynamics.

2.6. Andragogy, characteristics of the adult learner

Throughout his professional career Knowles (1975, 1978, 1980, 1984, 1989, 1990) put forward 6 andragogical principles, in this sense we have:

- The need to know: This principle is based on the assumption that adults need to know why they must learn something before undertaking the learning and using it in their real life, which is why adult learners need information on how they are going to learn, what they are going to learn and why it is important. In this regard, Tough (1971) refers that when a student decides to learn by himself, he inquires about the benefits he can obtain from such learning and the negative consequences of not acquiring it. In this sense, the teacher must make the students aware of the need to know, so that they can access knowledge by themselves in a timely manner and produce meaningful learning.
- Self-concept: It is important to take into account that the adult student has the self-concept of being responsible for his own decisions, of being a self-directed and autonomous person. As a person matures, his or her self-concept changes from being a dependent person to being a self-directed human being. Knowles and Kolb (2005) emphasize that the teacher must identify, guide and respect decisions about the level of autonomy of the adult learner. Considering these characteristics, it is important that the teacher avoids creating situations that cause the adult learner to feel that he/she is trying to impose or order him/her, since this could cause discomfort or resistance.
- The role of experience: It should be considered that adult students come to the educational activity with a high level of experience, needs, interests and objectives, which is why emphasis should be placed on individualized teaching. Thus, Sanchez (2015) in his doctoral thesis entitled "The Andragogy of Malcom Knowles: Theory and Technology of Adult Education" mentions that: "some of the techniques that take advantage of the adult learner's experience are discussion groups, simulation exercises, problem solving, case studies, laboratory methods and peer help activities" (p.97).
- Readiness to learn: This principle assumes that adult learners are prepared to learn what they need to cope with situations in their daily lives. Knowles

(1980) refers that it is possible that this disposition does not come naturally, so he recommends using strategies such as professional orientation or simulation exercises. Taking into account the aforementioned aspects will allow the development of the student's disposition towards learning.

- Learning orientation: Unlike pedagogy where learning is focused on the accumulation of content to be promoted to a higher level, in andragogy the learning orientation is focused on life, task or problem. Adults are motivated to the learning process when they perceive that it will help them to perform tasks or face problems that arise in their context; for this reason, they learn more effectively when knowledge is presented in the context of the application of everyday life situations. Knowles (1980) refers that not taking into account this characteristic has been the main cause of adult students dropping out of literacy courses as well as university courses. For this reason, teachers should orient the learning process to situations of the students' context.
- Motivation. Although adult learners respond to external motivators such as: better jobs, salary increases, promotions, etc., Knowles (1980) refers that the most efficient motivators are internal pressures, such as: increasing job satisfaction, quality of life, self-esteem, etc.

2.7. Learning styles

There are several models and theories on learning styles, even though these have a different classification, they have similarities in common that allow understanding the behaviors of individuals and how they relate to the way they learn in order to determine which action may be more effective at any given time.

The following is a description of the model used in the research:

2.7.1. Bandler and Grinder's Neurolinguistic Programming Model

This model refers to the way in which the learner understands information through the senses. Bandler and Grinder (1982) also called this model visual-auditory-kinesthetic, referring to the fact that information can be represented visually, auditorily and kinesthetically. The following is a description of each of the characteristics of the systems proposed by these authors:

- Visual representation system: students who fall into this category learn best when information is represented visually. The visual representation system makes it easier for the student to absorb large amounts of information quickly.
- Auditory representation system: students in this system remember information in a sequential or orderly manner, learn best when they receive oral explanations and when they have the opportunity to explain the information to another person. The auditory system, unlike the visual system, does not allow us to relate or elaborate abstract concepts with ease; however, it is fundamental for learning languages or music.
- Kinesthetic representation system: this system refers to the ability of individuals to process information by associating it with their sensations or movements, it is used more frequently when learning a sport, this system is slower than the visual and auditory system, students who are located in this system need more time than others, because they learn differently. Students in this system learn best when they are involved in laboratory experiments or projects.

In addition, the aforementioned authors mention that 40% of individuals use the visual system, 30% auditory and 30% kinesthetic.

2.8.　Active learning methodologies for the virtual world

2.8.1.　Flipped Learning

There is confusion between the terms Flipped Classrom and Flipped Learning, so it is important to mention that, in 2014 the Flipped Learning Network (hereafter FLN), which is a learning network dedicated to providing knowledge, skills and resources for its implementation, modified the term Flipped Classrom (inverted classroom) to Flipped Learning (inverted learning). FLN (2014) mentions that, although both terms are correct, however, the second is more comprehensive due to the fact that inverting a classroom does not necessarily reverse learning. In this sense, inverted learning is defined as:

A pedagogical approach in which direct instruction is shifted from the group learning dimension to the individual learning dimension, transforming the remaining group space into a dynamic and interactive learning environment in which the facilitator guides students in the application of concepts and in their creative engagement with the course content (FLN, 2014, p.1).

According to the aforementioned considerations, we establish that Flipped Learning is a pedagogical model where the traditional class is inverted, to a class that involves the active learning of students, allowing the exposure to focus on the student and not the teacher, based on the information previously transmitted by the teacher through technological resources reviewed by students outside the classroom.

3.　Methods and materials

3.1　Approach

The research was based on the qualitative approach. In this regard Sampieri et al. (2014) states that qualitative research is based on an interpretative perspective focused on the understanding of its participants.

3.2　Scope

The research had a descriptive scope because we carried out a description of the didactic-pedagogical, technological and methodological aspects required to develop an EVEA, according to Monje-Alvarez (2011) this scope allows us to:

> Gathering the results of the observation in an exposition of the features of the phenomenon under study, according to criteria that give coherence and order to the presentation of the data, in order to arrive at the formulation of hypotheses. At the descriptive level, no hypotheses are put forward; the purpose of the descriptive stage is to generalize in order to arrive at the formulation of hypotheses (p. 95).

3.3　Design

The research was based on the grounded theory design, about this design Sampieri et al., (2014) states that through its application the researcher produces a general explanation or theory regarding a phenomenon, process, action or interactions that apply to a specific context from the perspective of participants, to develop hypotheses and variables or concepts that integrate it through a representation or visual model, which will later be contrasted with the previously analyzed literature.

3.4　Population and sample

In the research we used the "expert sample", with the purpose of generating more accurate hypotheses. Regarding the size of the sample Sampieri et al (2014) states:

There are no defined or precise parameters, inasmuch as the decision of the number of cases that make up the sample is the researcher's, as long as he/she takes into account the following factors:

- Operational capacity for collection and analysis (the number of cases we can realistically handle and according to the resources we have).
- The understanding of the phenomenon (the number of cases that allow us to answer the research questions, later referred to as "category saturation").
- The nature of the phenomenon under analysis (whether the cases or units are frequent and accessible or not, whether collecting the corresponding information takes little or a lot of time) (p. 384).

Taking into account the aforementioned aspects, the research sample consisted of 8 experts on the subject of EVEA design and implementation, as follows:

Interviewees	Years of experience in EVEA construction	Function
Expert 1	15 years	PhD. in Computer Science. Professor UCE. Professor PUCE
Expert2	10 years	Master in Higher Education Doctorate in Education. Teacher at UCE.
Expert3	5 years	PhD. in Educational Research. Lecturer UCE. Director of the Pedagogy of Experimental Sciences and Computer Science Department.
Expert4	10 years	Master in New Technologies Applied to Education. Specialization in Virtual Learning Environments Teacher UCE
Expert5	7 years	Master in systems Teacher UCE
Expert6	6 years	Master in Systems Computer scientists Educational. UCE teacher.
Expert7	7 years	Instructional Designer. Academic Development Directorate UCE.
Expert 8	5 years	Instructional designer. Teacher.

Cuadro 3. Docentes expertos entrevistados

3.5 Research techniques and instruments

The technique used for data collection was the "qualitative interview" which according to Sampieri et al., 2014 is defined "as a meeting to discuss and exchange information between one person (the interviewer) and another (the interviewee) or others (interviewees)" (p. 403). In addition, the type of interview we selected for the research was semi-structured with the purpose of offering the interviewees a guide of questions, and that the researcher has the freedom to introduce additional questions to clarify concepts or obtain more information. Finally, for the choice of the types of interview questions we used the classification of Mertens (2010) and from this classification we selected knowledge and opinion questions.

3.6 Validity of the instruments

The validation of the instrument was carried out by means of the judgment of three experts specialized in the proposed subject matter (construction of EVE).

3.7 Dependency criterion

In qualitative research, dependence, also called logical consistency, represents "quantitative reliability", and refers to the fact that the data collected are reviewed by different researchers and their interpretations should be congruent, i.e., the results should be equivalent (Sampieri et al., 2014).

In this sense, to ensure that the research meets the criterion of dependence, the interviews were analyzed by two experts in the field, so that the categories obtained from the analysis were equivalent as follows:

Categories expert 1	Categories expert 2
Considerations for selecting an instructional design for the construction of EVEAs	Importance of instructional design in EVEAs
Didactic criteria for developing virtual educational resources and activities.	Design of virtual educational activities
	Design of virtual educational resources
ICT tools for the construction of activities and resources in EVEAs	ICT tools for learning support
Elements to consider when designing the interface of an EVEA	EVEA navigation interface
Teacher's role for adult learners	Characteristics of adult learners
Strategies to address learning styles	Learning styles
Autonomous learning	Autonomous learning
Collaborative learning	Collaborative learning
Considerations for selecting active learning methodologies in EVEAs	Selection of active learning methodologies in EVEA

Table 4. Interview dependency criteria

3.8 Data processing techniques

For data processing we used the ATLAS.TI 8 software, because this software allowed us to carry out foreground coding (open coding to form categories) and background coding (axial coding) of the data obtained in the interviews and to build theory by relating concepts, theories and themes.

3.9 Data analysis techniques

Taking into account that for the development of the research we relied on the qualitative approach and the grounded theory design, the steps we followed for the data analysis were those of the emergent conception. Sampieri et al. (2014) states that, in this design, data analysis is carried out by means of open coding to generate categories, which are connected to each other to produce theory, and which is represented graphically to then be contrasted with the previously analyzed literature. The following is a graphic description of the process followed by the research for the analysis of the data collected.

Taking into account that for the development of the research we relied on the qualitative approach and the grounded theory design, the steps we followed for the data analysis were those of the emergent conception. Sampieri et al. (2014) states that, in this design, data analysis is carried out by means of open coding to generate categories, which are connected to each other to produce theory, and which is represented graphically to then be contrasted with the previously analyzed literature. The following is a graphic description of the process followed by the research for the analysis of the data collected.:

Figure 2. Process of Qualitative Research Based on Grounded Theory Design under an Emergent Conception.
Source: (Sampieri et al, 2014)

4. Results

4.1 Category: Didactic Aspects

4.2 Subcategory: Instructional Design
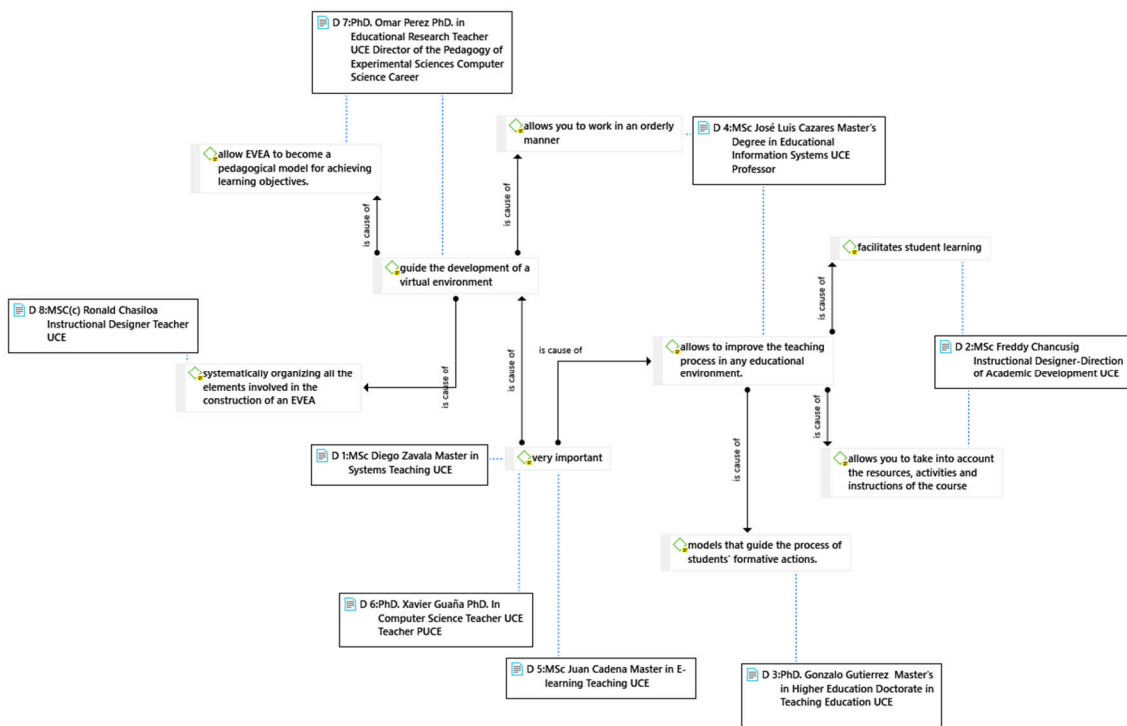
Figure 3. Conceptual network: importance of instructional design in EVEA

For the development of EVEA, the use of instructional design is extremely important because its use guides its development since it allows the organization of all the elements implicit in the construction of an EVEA such as resources, activities, and course instructions. Faryaid (2007) asserts that instructional design allows the teacher to conceptualize and

design, create and implement resources and activities that will allow the training process to be carried out adequately. In addition, Belloch (2013) states that instructional design allows the construction of clear and effective learning environments, resources and activities.

Regarding the selection of an instructional design model, the experts interviewed agree on the use of the ADDIE instructional model due to its flexibility and "the strength it has gained in recent years because it is a generic model" (Castillo, 2009, p.4). According to the interviewees, its phases allow building quality EVEA because they take into account all the implicit elements that will be part of the EVEA such as the application group, contents, activities, technological features, learning strategies, evaluation processes and follow-up strategies to determine whether the proposed learning outcomes have been achieved.

4.3 Subcategory: Design of virtual educational activities
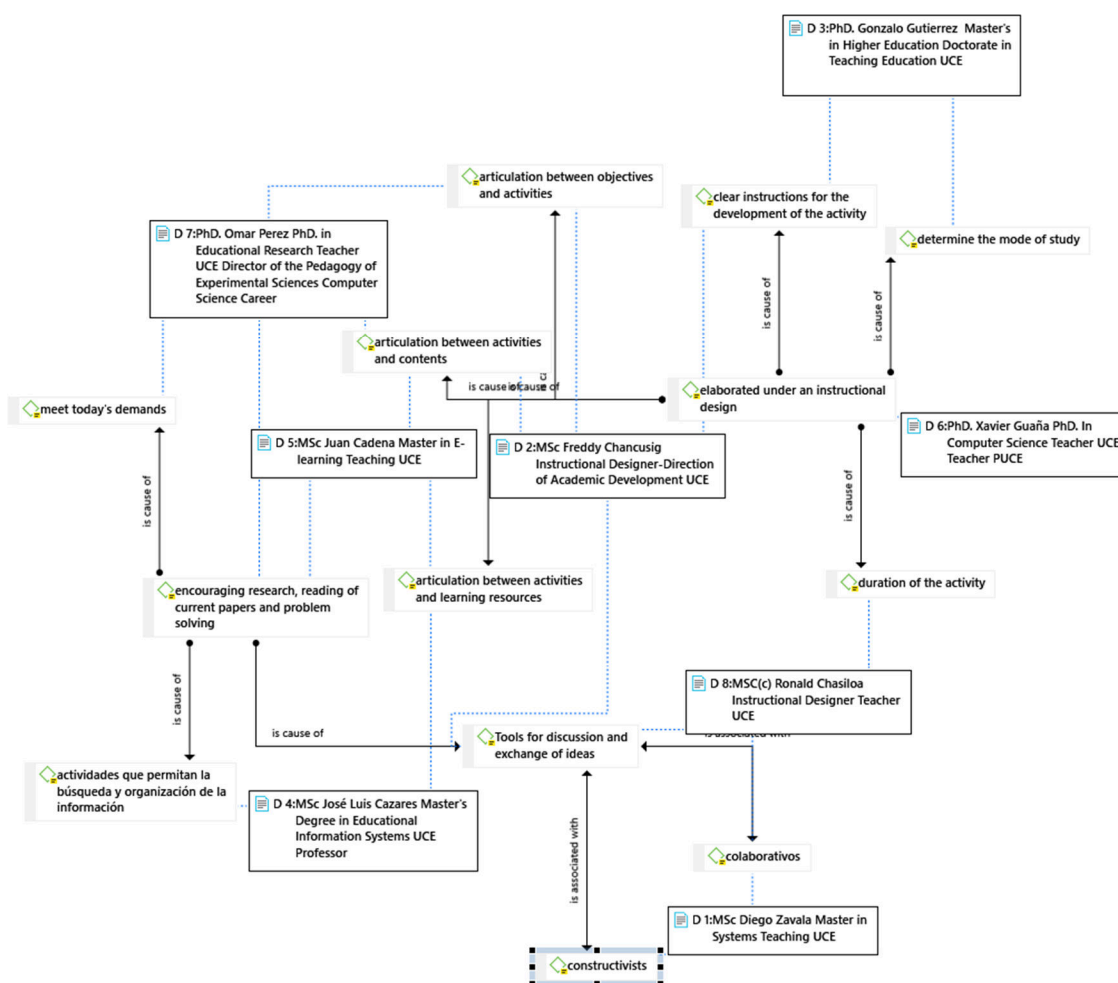
Figure 4. Conceptual network: Didactic criteria for the design of activities in EVEA.

For the design of activities, the interviewees agree that there must be an articulation between the contents, objectives, resources and the activity, as well as the duration of the activity and the instructions for its completion, in addition to encouraging the exchange of ideas, debate, research, reading and problem solving. Cabero and Román (2006) strengthen this approach since they assert that the most important aspects for the design of virtual activities are: specifying the instructions for carrying out the activity, determining the limits for its realization, determining how it will be sent, establishing the resources to be used for its realization and determining the evaluation criteria of the activity, as well as the author

mentions that the activities should be oriented to the resolution of problems in which the students are involved. In reference to the type of virtual activities to develop higher mental capacities in students, it is recommended to use collaborative work (forums, wikis, workshops); and autonomous work (essays, homework, projects and graphic organizers). Churches (2009) refers to the use of Bloom's digital taxonomy to select virtual activities according to the capacity to be developed in the student body

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4.4 Subcategory: Design of virtual educational resources.
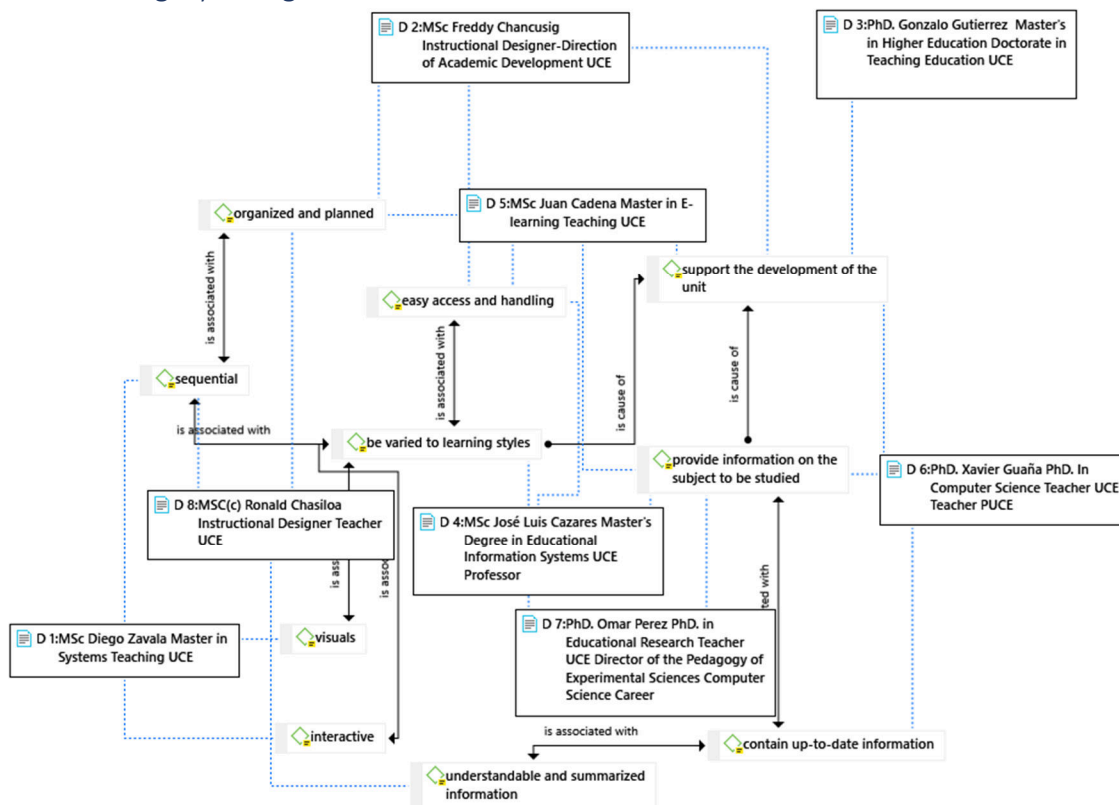
Figure 5. Conceptual network: virtual activities to develop higher mental capacities in students.

For the design of virtual educational resources, the interviewees agreed that they must meet the following characteristics:

a) Be varied (text, audio, images, videos) due to the different learning styles of students.
b) They should be sequentially elaborated.
c) They should be easily accessible.
d) They should support the development of the unit.
e) They should contain updated, summarized and understandable information on the topic to be studied.

Among other characteristics, Zapara (2012) states that in order to develop educational resources it is necessary to establish their objectives to delimit the contents that will be part of them and recommends supporting their presentation through ICT tools. Finally, he recommends using digital educational resources according to the cognitive level, so that if you want to explore concepts, the use of documents, hypertexts and audiovisual resources is recommended, and for the consolidation of learning, the use of simulators or educational games is recommended.

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4.5 Category: Technological Aspects

4.6 Subcategory: ICT tools external to the Moodle platform for learning support.
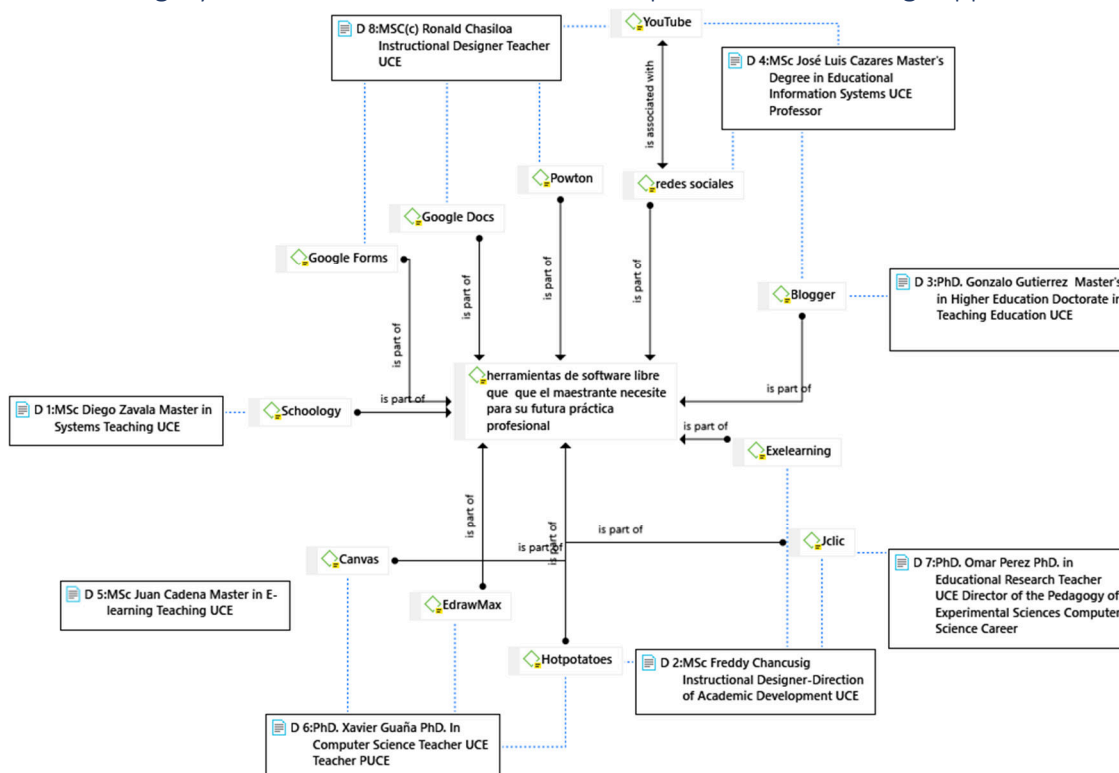
Figure 6. Conceptual network: ICT tools external to the Moodle virtual platform for the construction of activities and resources.

As ICT tools external to Moodle that allow teachers to build activities and resources, the interviewees suggest the following tools:

a) Social networks such as: YouTube and Blogger
b) Evaluation tools such as: HotPotatoes and Jclic
c) Interactive presentation tools such as: PowToon
d) Easy-to-use graphic design tools such as: Canvas
e) Diagramming tools to make flowcharts, flowcharts, mind maps, network diagrams, etc. such as: EdrawMax.

Tools that facilitate collaborative work such as: Google Docs and Google Forms.

4.7 Subcategory: Moodle ICT tools for learning support
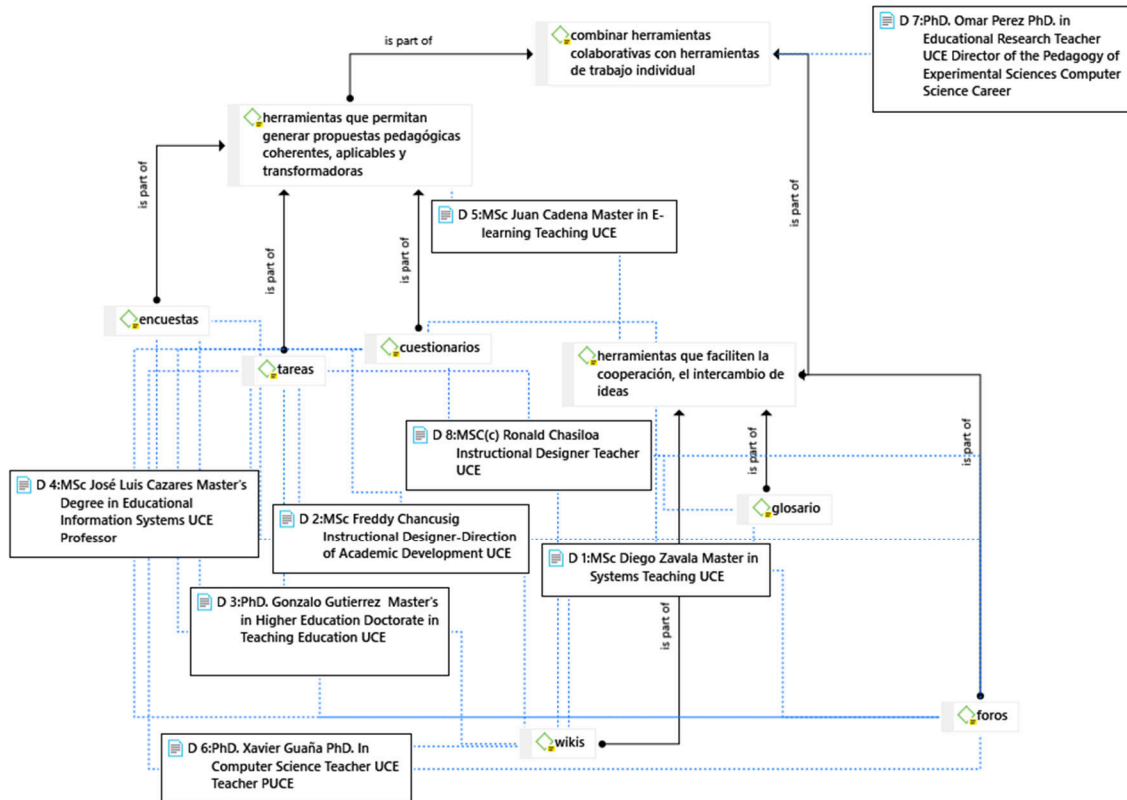
Figure 7. Conceptual network: ICT tools of the Moodle virtual platform for the construction of activities and resources.

As the most recommended ICT tools of the Moodle platform for teachers to build activities and resources, the interviewees suggest using tools that allow the development of autonomous and collaborative work.

Among the tools for autonomous work, they suggest the use of the Tasks activity as long as they are focused on generating coherent pedagogical proposals, applicable to reality and innovative. Finally, among the tools that facilitate collaborative work and exchange of ideas, they recommend the use of: Wikis, Forums and Glossaries.

4.8 Subcategory: EVEA Navigation Interface.
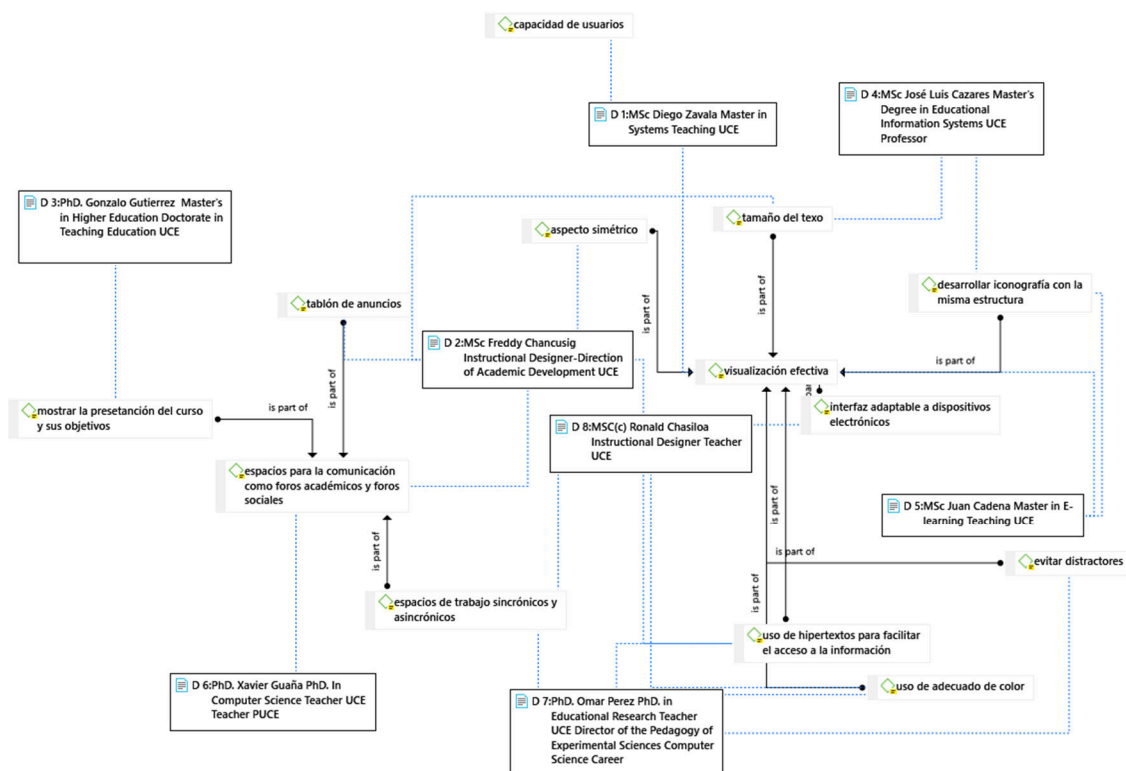
Figure 8. Conceptual network: technical aspects for the design of an EVEA.

Among the technical considerations to be taken into account in the construction of an EVEA, the interviewees mentioned the following:

a) Construction of spaces for academic and social communication such as:
- Bulletin board with relevant course information.
- Synchronous and asynchronous workspaces..
b) Effective visualization, i.e.:
- Use of hypertext to facilitate access to information.
- Appropriate use of color and text size.
- Develop a uniform iconography within the course.
- Avoid distracting.

Rivera (2005) affirms that, in EVEAs, the graphic interface design is fundamental and must provide students with the necessary elements to make the communication of content effective, provide the necessary visual character and expose the content according to the type of users to whom it is addressed. In addition, González (2004) asserts that the interface must support, help and guide the user, so it must: a) avoid saturation and unnecessary placement of elements; b) organize the information in a logical and hierarchical way to access it easily and locate it effectively; c) be consistent in all sections of the platform, graphics and text size, and; d) with regard to resources and activities, the text and graphics used must be related to each other; e) be consistent in all sections of the platform, graphics and text size, and; f) be consistent in all sections of the platform, graphics and text size, and; g) in terms of resources and activities, the text and graphics used must be related to each other, and; h) be consistent in all sections of the platform, graphics and text size.

4.9 Category: EVEA Learning

4.10 Subcategory: Characteristics of adult learners (andragogy).
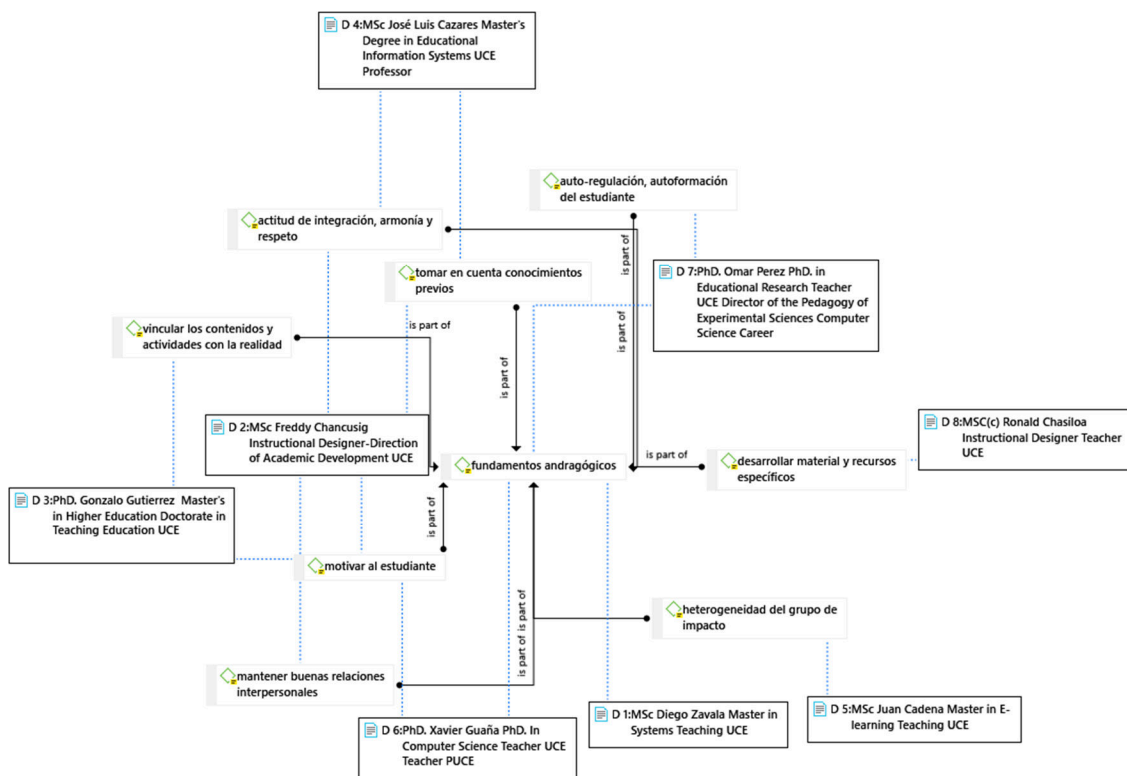
Figure 9. Conceptual network: andragogical aspects

Among the aspects to be considered in the student learning process, the interviewees refer to the andragogical foundations and state that the following should be taken into consideration:

a) Motivate students to encourage self-regulation and self-education.
b) To link contents and activities with real-life problems.
c) Develop good interpersonal relationships between teachers and students.
d) To take into account the heterogeneity of the group in terms of learning styles, through the development of varied educational resources.

Knowles (1984) concerning adult learning or andrology supports the statements of the interviewees and states the following:

a) Consider aspects such as making the student aware of the need for learning, so that he/she can find out for him/herself the benefits that can be obtained by acquiring such learning.
b) Carry out activities that are oriented to face problems in their context to awaken their interest and learn more effectively.
c) Avoid creating situations in which the student perceives that the teacher is imposing or ordering. Knowles and Kolb (2005) affirm that the teacher must respect the decisions about the level of autonomy of the adult students. Considering these aspects will help to avoid situations of resistance to learning.
d) Consider the diversity of the student body in terms of learning styles, needs and objectives.

Furthermore, according to the experts interviewed and the contrasted information of the authors cited above, the teacher should assume the role of guide in the teaching process, becoming a motivator and intermediary of knowledge, in addition, for a better practice of the teaching process and to apply the considerations mentioned above, the teacher should be an expert in the subject so as to provide students with: a) current knowledge that will allow them to strengthen their professional practice; b) appropriate scientific material for their analysis, and; c) outline the students to lines of research.

Finally, with regard to the role that students should assume in the learning process, it is mentioned that they should be active participants, critical and aware of the need for learning. Tough (1971) asserts that when a student decides to learn by himself, he inquires about the benefits he can obtain from such learning and the negative consequences of not acquiring it. Therefore, much attention should be paid to these aspects in order to maintain a constant learning attitude and provide ideas for problem solving.

4.11 Subcategory: Learning styles
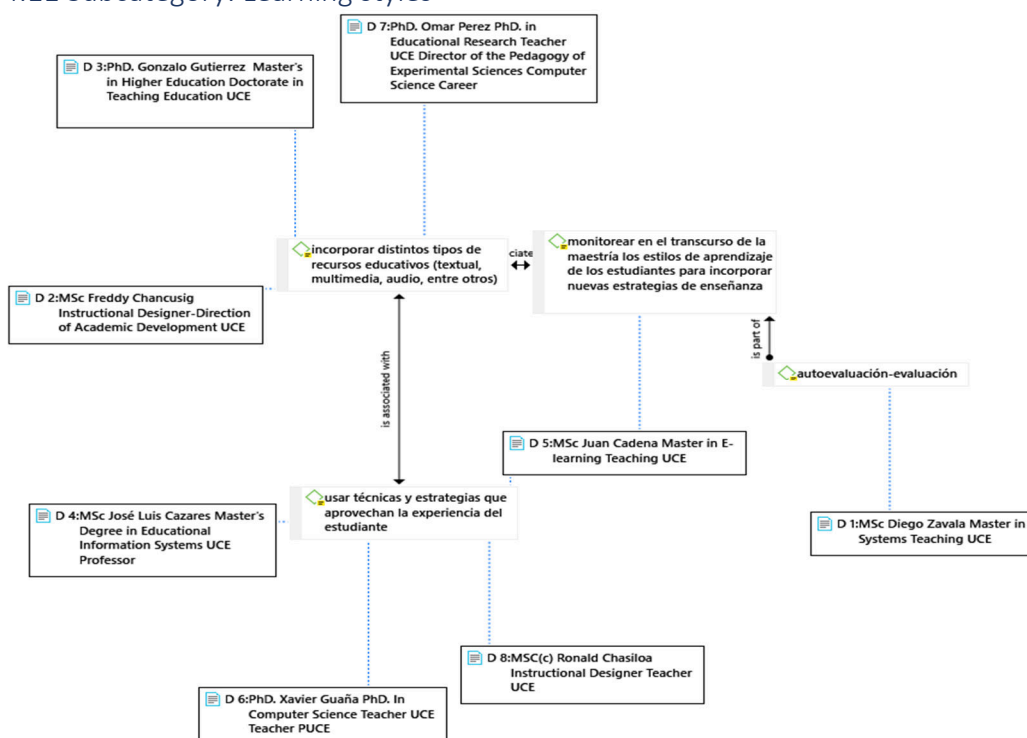
Figure 10. Conceptual network: strategies to address the different types of student learning.

The following strategies are suggested to address the different types of student learning styles:

a) a) Incorporate different types of educational resources (texts, images, audios) in the EVEA. Bandler and Grinder (1982) assert that information can be represented visually, auditorily and kinesthetically and that people learn 40% visually, 30% auditorily and 30% kinesthetically. Therefore, it is necessary to develop resources that allow learning in the aforementioned ways.

b) b) Use techniques and strategies that take advantage of the student's experience. In this regard, Sánchez (2015) mentions that "some of the techniques that take advantage of the adult learner's experience are discussion groups, simulation exercises, problem solving, case studies, laboratory methods and peer assistance activities" (p. 97).

It is important to take these two strategies into account when designing activities and resources within the EVEA.

Finally, it is emphasized that the teacher should continuously monitor how the students perform during the course in order to make the necessary adjustments in the activities, resources or teaching strategies.

4.12 Subcategory: Active learning methodologies
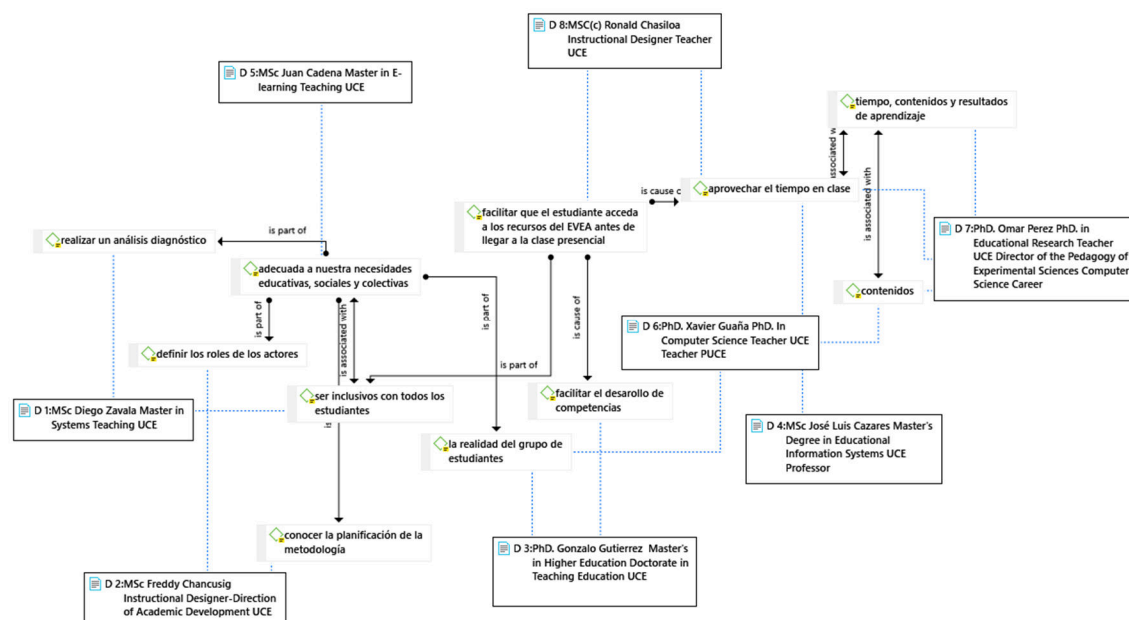
Figure 11. Conceptual network: factors for selecting an active learning methodology in EVEA

Finally, in terms of criteria for selecting active learning methodologies, the interviewees refer to the following areas:

a) a) Select methodologies that are adapted to the educational, social and collective needs: considering the group of students to whom the module is addressed and being inclusive with them.

b) b) Take advantage of class time: in this regard, students should be given access to the EVEA resources so that they can analyze them before coming to the classroom..

According to the criteria of the experts interviewed, emphasis is placed on the use of ICT with face-to-face teaching practice, in this sense, the use of the technological approach to B-Learning is recommended. Bartolomé (2008) strengthens this approach since he affirms that this approach allows taking advantage of the benefits of ICT and face-to-face training providing:

> a) equal learning opportunities through flexibility and adaptability; b) facilitate student access to learning resources and activities; c) offer students a greater variety of resources and activities to face diverse learning situations; and, d) allow the articulation of the needs of the actors involved in the learning process (p. 18).

Finally, in order to optimize class time and take into account the characteristics of adult students analyzed above, the use of the active learning methodology Flipped Learning is recommended, because in this methodology the students have a more leading role in the classroom, since they analyze the contents provided by the teacher through technological resources and take advantage of class time by applying the knowledge previously acquired

with the guidance of the teacher, through the solution of problems oriented to their professional practice and solution of real situations. FLN (2014) asserts that the application of this methodology allows: a) taking into account the learning styles of students by offering varied activities; b) making the student become the protagonist of learning by assuming the responsibility of analyzing the resources, interacting with the teacher and classmates and contributing with ideas for problem solving; c) selecting activities and resources according to the learning objective; and, d) having the teacher assume the role of facilitator to provide feedback, follow-up and continuous evaluation.

5. Conclusions

In order to build an EVEA to guarantee quality learning, the research reached the following conclusions:

a) For the construction of an EVEA it is extremely important to start from an instructional design in order to conceptualize, design, organize, create and implement the activities and resources that will be part of the EVEA, to achieve the learning achievements.

b) Although there are a great variety of instructional design models, we recommend the use of the ADDIE model because it is a virtual didactic methodology at the university level according to the MOODLE platform, it fits in any educational environment and its phases take into account all the implicit elements that will be part of the EVEA such as the students to whom the course is addressed, technological characteristics, contents, activities, learning strategies, evaluation processes and follow-up strategies to determine if they have achieved the proposed learning outcomes.

c) The activities that are part of EVEA must be related to the objectives and content of the module and/or subject, and must also be focused on encouraging debate, exchange of ideas, research and problem solving in the professional field in which the students work. In order to design them: a) provide clear instructions for their realization; b) establish the time for their realization; c) provide additional resources for their realization; and, c) make known the criteria for the evaluation of the activity.

d) In reference to the type of activities that will be part of an EVEA, the use of collaborative work (forums, wikis, workshops) and autonomous work (essays, homework, projects) is recommended, based on the use of Bloom's digital taxonomy, which mentions the type of activity that can be developed according to the capacity that is desired to develop in the students and the level of complexity.

e) The virtual educational resources must contain updated and understandable information to support the development of the unit, they must also be varied to meet the different types of learning styles of students, the use of text, audio, images, videos, etc. is recommended and all the facilities must be provided for the student to access them according to their learning styles.

f) It is suggested to use ICT tools that allow the development of autonomous and collaborative work, as tools for the development of autonomous work it is recommended the use of tasks focused on generating coherent pedagogical proposals, applicable to reality and innovative, and as tools to strengthen collaborative work tools that allow the exchange of ideas and encourage dialogue such as: Wikis, Forums and Glossaries.

g) Among the technical considerations to be taken for the design of an EVEA are: a) the creation of a bulletin board with relevant information of the module; b) the use of hypertext to facilitate access to information; c) adequate use of color and text size; development of a uniform iconography within the course; and, e) avoiding the unnecessary use of visual elements or resources in the EVEA.

h) Among the aspects to be considered in the student learning process are the following:
  o Make students aware of the need to learn in order to motivate them in the learning process.
  o The activities carried out by the students should be oriented to the resolution of problems of their professional context to awaken their interest and learn more effectively.
  o The autonomy and experience of the students should be taken into account in this sense the teacher should avoid situations in which the student feels that the teacher is imposing or ordering, so as not to cause resistance to learning.
  o Take into account the heterogeneity of the group in terms of learning styles.
i) Regarding the roles of the teacher and the students:
  o The teacher must assume the role of guide in the teaching process, becoming a motivator and intermediary of knowledge. In addition, they should be experts in the subject matter to provide students with: a) current knowledge that will allow them to strengthen their professional practice; b) current contents; and c) outline the students' research lines.
  o The role of the students in the learning process should be active, participatory, critical and aware of the need for learning, providing ideas for the solution of problems.
j) In order to cater to the different types of student learning styles, different types of educational resources should be incorporated in the EVEA, in addition to using activities that take advantage of the student's experience, such as discussion groups, simulation exercises, problem solving, case studies, etc.
k) For the selection of active learning methodologies that are part of the EVEA, the following should be used:
  o o Select methodologies that are adapted to the educational, social and collective needs.
  o o Consider the group of students to whom the module is addressed.
  o o Be inclusive of all students in order to serve a diverse world.
  o o Select methodologies and approaches that make the best use of class time.
  o o Strengthen the teaching and learning process with ICT tools.

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Establishing the digital accessibility care unit at the Tecnológico Nacional de México / IT Aguascalientes

Estableciendo la unidad de atención a la accesibilidad digital en el Tecnológico Nacional de México / IT Aguascalientes

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Abstract

The objective of this work was to present the set of basic services of the Digital Accessibility Attention Unit of the Tecnológico Nacional de México / IT Aguascalientes (TecNM/ITA), as well as its initial integration into the organizational structure of the institution. These actions were carried out within the framework of the project "Technological assistance to

accessibility in Virtual Higher Education, EduTech", registration number: 609785-EPP-1-2019-1-ES-EPPKA2-CBHE-JP, co-financed by the ERASMUS+ program of the European Union. In this sense, emphasis was placed on the implementation of the results derived from two deliverables of said project: "1.1 Report on the state of the art of technological accessibility care units applied to Higher Education", and "2.1 Guide for the implementation and management procedures of a technological accessibility care unit applied to Higher Education". The findings and recommendations of these deliverables made it possible to establish the foundations of the first Digital Accessibility Attention Unit in the entire national technological system, which has 254 institutes throughout the country. It is hoped that the content of this article will inspire other Higher Education Institutions (HEI) to create their own Digital Accessibility Attention Units.

Keywords
Attention units, curricular adjustments, digital or technological accessibility, HEI, reasonable adjustments.

Resumen
El objetivo de este trabajo fue presentar el conjunto de servicios básicos de la Unidad de Atención a la Accesibilidad Digital del Tecnológico Nacional de México / IT Aguascalientes (TecNM/ITA), así como su integración inicial a la estructura orgánica de la institución. Dichas acciones se llevaron a cabo en el marco del proyecto "Asistencia tecnológica a la accesibilidad en la Educación Superior Virtual, EduTech", número de registro: 609785-EPP-1-2019-1-ES-EPPKA2-CBHE-JP, cofinanciado por el programa ERASMUS+ de la Unión Europea. En este sentido, se enfatizó la implementación de los resultados derivados de dos entregables de dicho proyecto: "1.1 Informe del estado de arte de unidades de atención a la accesibilidad tecnológica aplicada a la Educación Superior", y "2.1 Guía de implantación y procedimientos de gestión de una unidad de atención a la accesibilidad tecnológica aplicada a la Educación Superior". Los hallazgos y recomendaciones de estos entregables permitieron establecer los cimientos de la primera Unidad de Atención a la Accesibilidad Digital en todo el sistema nacional de tecnológicos, el cual cuenta con 254 institutos a lo largo del país. Se espera que el contenido de este artículo inspire a otras Instituciones de Educación Superior (IES) para que conformen sus propias Unidad de Atención a la Accesibilidad Digital.

Palabras clave
Accesibilidad digital o tecnológica, adaptaciones curriculares, adaptaciones razonables, IES, unidades de atención.

1. Introduction

To provide a clearer idea of the context of this article, three important aspects will be described in this section: the objectives and characteristics of the Digital Accessibility Attention Units, a summary of the project "Technological Assistance for Accessibility in Virtual Higher Education, EduTech", and a summary of the national technological system in Mexico.

1.1 Technological Accessibility Attention Units

The Support Services for People with Disabilities in Universities are also known as: Program/Service/Unit/Office of Attention/Support to Disability, Unit of Attention to Technological/Digital Accessibility, Unit for Equality and Attention to Disability, Inclusive Education Unit, Student Support Center, among other similar names. The general objective of this type of services is "to guarantee the full inclusion and participation of university

students with disabilities, contemplating their individuality, through effective equal opportunities and non-discrimination in academic life, as well as the promotion of awareness and sensitization of all members of the community" (Universia Foundation, 2017, p. 23). Achieving this objective entails the following specific aspects: incorporating accessibility into the university admission process; sensitizing and raising awareness among the university community for the proper implementation of accessibility policies and standards in favor of people with disabilities; offering academic support services to students with disabilities; ensuring accessibility in the university environment (infrastructure, equipment, information, services, teaching-learning process) including virtual space; promoting collaboration and synergy between the university community and foundations, organizations, or external institutions in favor of care for students with disabilities; modify current guidelines (and/or generate new ones) in order to formalize and preserve the adequate attention to the needs of students with disabilities; encourage industry and government to promote job placement and future hiring of students/graduates with disabilities; incorporate accessibility training programs for those involved in the teaching-learning process; and modernize the care processes in university service centers by fostering an inclusive culture in favor of people with disabilities (Fundación Universia, 2017; Peralta and Comunitaril, 2011; Porto Castro and Gerpe-Pérez, 2020; United Nations, 2006).

Based on these specific objectives and the general aspects to consider in this type of services pointed out by Fundación Universia (2018), the following ideal characteristics were identified for disability services in HEIs:

- The unit operates directly as a service, office, or internal/specific area in the university. Although this is the most common form of operation, it can also operate through a foundation, or as a shared task between 2 or more services, offices, or internal areas in the university.
- The unit depends organically on a vice-rectorate or sub-directorate (the most common organizational structure), management or other administrative area, or on a foundation.
- The unit's work teams are multidisciplinary (psychologists, pedagogues and psychopedagogues, physiotherapists, sign language interpreters, among others) and inclusive (e.g., men, women, staff with disabilities).
- The care unit of a university works together with similar units in other universities, other care units in the university itself (e.g., psychological care), public and/or private institutions that work with disabilities.
- The care unit encourages the voluntary participation of students by recognizing with academic credits their collaboration in support services for people with disabilities at the university.
- The care unit has a continuous improvement process or an internal evaluation system, its own or based on any quality assurance standard (e.g. UNE-EN ISO 9001:2015 standard).
- The unit considers personalized strategies for induction to the university environment, orientation, tutoring, follow-up, support, and counseling for students with disabilities, involving the processes of admission/enrollment of new students, university training, and graduation, and even job placement.
- The unit ensures that academic rigor is maintained in the training of students with disabilities by maintaining constant communication with students and professors to solve problems of accessibility in the facilities, information or necessary curricular adaptations.

- The unit ensures mechanisms for students with disabilities to participate in the various student mobility programs (state, national, international) including student participation with industry (e.g. internships).
- The unit has the necessary mechanisms to promote the employability and labor inclusion of students with disabilities through strategies such as job orientation and support in defining career goals. It also carries out internship programs in companies, communication of job offers received and even the management of job exchanges through the areas of university linkage and / or employment service of the university.
- The unit ensures the adaptation of study places for people with disabilities in the context of the concepts of curricular adaptations and reasonable adaptations, for example, reserved seating in classrooms, recording of classes, adaptation of furniture, incorporation of magnetic loops in lecture halls, accessible educational materials, extension of time for exams, curricular adaptation, among others.
- The unit ensures reasonable adaptations can be made in different ways according to the resources available at the university, for example, provision of specific software and hardware, digitization of content with accessibility criteria, and subtitling of audiovisual material.

1.2 The project "Technological Assistance for Accessibility in Virtual Higher Education, EduTech"

The idea of the project was born at the University of Alcalá de Henares, Madrid, Spain, as an initiative of Dr. Salvador Otón Tortosa, Research Professor at the University of Alcalá de Henares. The project was selected to be co-funded by the ERASMUS+ program, "Key Action 2: Capacity Building in Higher Education", for its acronym in English: "KA2: CBHE", of the European Union in its 2019 call. The EduTech project seeks to generate attention units to manage the different aspects related to technological accessibility in higher education, a purpose that is integrated from the same acronym of the project: "Edu" that represents inclusive education and "Tech" that represents the Information and Communication Technologies (ICT) in HEIs, and in Nahuatl (Mexican indigenous language) represents the terms "We or for us".

The project will be in force until 2023 and its development is carried out through the collaborative work of eight partner institutions: Universidad Alcalá (UAH, Spain), Østfold University College (HiOF, Norway), Universidad de Alicante (UA, Spain), Universidade Aberta (UAb, Portugal), Tecnológico Nacional de México/Instituto Tecnológico de Aguascalientes (TecNM / ITA, Mexico), Universidad Veracruzana (UV, Mexico), Universidad Politécnica Salesiana (UPS, Ecuador), and Universidad del Azuay (UDA, Ecuador).

The EduTech project focuses on finding solutions to five main problems in the context of technological accessibility in higher education:

1. The lack of a unit or department model in HEIs that deal with the different aspects related to technological accessibility.
2. The lack of documentation or training material for HEIs in relation to success cases and good practices in: Student attention in accessible technology aspects; Tools for accessible virtual training; Accessible virtual campuses with accessibility features; Accessible learning objects and OERs; Accessible Massive Open Online Courses (MOOCs); Quality in accessible virtual training and Training aspects to involved in the teaching-learning process.
3. The need to improve the technological infrastructure and management capacities for Accessible Virtual Higher Education in Latin American partner universities.

4. The lack of massive training programs on topics of the "Agenda for new skills and jobs" of the 2020 Strategy, especially oriented to vulnerable groups such as people with disabilities.
5. The lack of a common space for technological accessibility units in HEIs to share success stories and best practices.
6. To achieve the above, the following specific objectives of the action were established.
7. To assist Latin American (LA) and European Higher Education Institutions (HEI) in setting up technological accessibility care units, replicable and adaptable according to the characteristics of the institutions, and to train the staff involved in these care units.
8. Create a volume on accessibility, consisting of six guides on the main accessibility issues: (1) Guide for the implementation of technological accessibility management units in HEIs; (2) Technical guide for accessible and adaptive virtual campuses for the implementation of e-learning; (3) Technical guide for the creation and management of accessible OERs and MOOCs; (4) Guide for self-evaluation of accessible virtual quality; (5) Guide for accessibility training of personnel involved in the teaching and learning process. (6) Guide on good practices for the employment of people with disabilities.
9. Develop a series of tools to support accessibility for teachers and students (for example: accessibility plugins for Moodle, repositories of learning objects and OERs, and job simulators) implementing the results and recommendations of the guides prepared in objective 2.
10. Improve the technological infrastructure and management capacities of partner HEIs for an Accessible Virtual Higher Education.
11. Promote the labor and educational insertion of students with disabilities.
12. Support Latin American HEI partners to advance in the creation of an inclusive virtual higher education space, as a way to consolidate the common ALCUE (Latin America, Caribbean and European Union Summit) Higher Education space, through the expansion of existing cooperation networks with a cooperation network of technological accessibility units.

1.3 The National Technological System and the Tecnológico Nacional de México

Los primeros Institutos Tecnológicos (IT) surgieron en México en el año de 1948, fueron Durango y Chihuahua los estados en los que se asentaron, con el propósito de impulsar la ciencia y tecnología regional. Poco tiempo después se fundaron los de Saltillo (1951) y Ciudad Madero (1954). Hacia 1955, estos primeros cuatro Tecnológicos atendían una población escolar de 1,795 alumnos, de los cuales 1,688 eran hombres y sólo 107 mujeres. En 1957 inició operaciones el IT de Orizaba. En 1959, los Institutos Tecnológicos son desincorporados del Instituto Politécnico Nacional, para depender, por medio de la Dirección General de Enseñanzas Tecnológicas Industriales y Comerciales, directamente de la Secretaría de Educación Pública. En el libro La Educación Técnica en México. Institutos Tecnológicos Regionales, editado por la Secretaría de Educación Pública en 1958, se marcó la desincorporación plena de los IT y el inicio de una nueva etapa caracterizada por la respuesta que dan estas instituciones a las necesidades propias del medio geográfico y social, y al desarrollo industrial de la zona en que se ubican. Al cumplirse los primeros veinte años, ya se contaba con diecisiete IT, los cuales estaban presentes en catorce estados de la República Mexicana. En la década siguiente (1968-1978), se fundaron otros 31 Tecnológicos, para llegar a un total de 48 planteles distribuidos en veintiocho entidades del país. Durante esta década se crearon también los primeros centros de investigación y apoyo a la educación tecnológica, es decir, el Centro Interdisciplinario de Investigación y Docencia en Educación Tecnológica (CIIDET, 1976) en Querétaro y el Centro Regional de Optimización y Desarrollo de Equipo (CRODE), en Celaya. En 1979 se constituyó el Consejo

Nacional del Sistema Nacional de Educación Técnica (COSNET), el cual representó un nuevo panorama de organización, surgiendo el Sistema Nacional de Educación Tecnológica, siendo los Institutos Tecnológicos parte fundamental para la integración del Sistema Nacional de Institutos Tecnológicos (SNIT). De 1978 a 1988 se fundaron doce nuevos Tecnológicos, dos Centros Regionales de Optimización y Desarrollo de Equipo (Chihuahua y Mérida), y el Centro Nacional de Investigación y Desarrollo Tecnológico (CENIDET).

La investigación y los posgrados se impulsaron con gran intensidad gracias a la creación progresiva de los Centros Regionales de Estudios de Graduados e Investigación Tecnológica (CREGIT) en cada uno de los planteles. Para 1988, los IT atendían una población escolar de 98,310 alumnos, misma que en los cinco años siguientes creciera hasta 145,299, con una planta docente de 11,229 profesionales y 7,497 empleados como personal de apoyo y asistencia a la educación. En 1990 iniciaron actividades los Institutos Tecnológicos Descentralizados, con esquemas distintos a los que operaban en los IT Federales, ya que se crearon como organismos descentralizados de los Gobiernos Estatales. En 1993 se crea el CRODE de Orizaba. Mientras que en 2005 se reestructuró el Sistema Educativo Nacional por niveles, lo que trajo como resultado la integración de los Institutos Tecnológicos a la Subsecretaría de Educación Superior (SES), transformando a la Dirección General de Institutos Tecnológicos (DGIT) en Dirección General de Educación Superior Tecnológica (DGEST). Como consecuencia de esta reestructuración, se desincorpora el nivel superior de la Dirección General de Ciencia y Tecnología del Mar y de la Dirección General de Educación Tecnológica Agropecuaria y se incorpora a la recién creada DGEST. El 23 de julio de 2014, fue publicado en el Diario Oficial de la Federación, el Decreto Presidencial por el que se crea la institución de educación superior tecnológica más grande de nuestro país, el Tecnológico Nacional de México (TecNM). De acuerdo con el Decreto citado, el TecNM se funda como un órgano desconcentrado de la Secretaría de Educación Pública, que sustituye a la unidad administrativa que se hacía cargo de coordinar este importante subsistema de educación superior. El Tecnológico Nacional de México está constituido por 254 instituciones, de las cuales 126 son Institutos Tecnológicos Federales, 122 Institutos Tecnológicos Descentralizados, cuatro Centros Regionales de Optimización y Desarrollo de Equipo (CRODE), un Centro Interdisciplinario de Investigación y Docencia en Educación Técnica (CIIDET) y un Centro Nacional de Investigación y Desarrollo Tecnológico (CENIDET). En estas instituciones, el TecNM atiende a una población escolar de más de 600 mil estudiantes en licenciatura y posgrado en todo el territorio nacional, incluida la Ciudad de México (TecNM, 2021).

1.4   Problem statement

Despite the fact that the technological system in Mexico has been in operation for more than 70 years, it was only in 2018 that work specifically oriented to accessibility and technological inclusion was initiated, this through a diploma course on inclusive education. Therefore, it is necessary to establish strategies that contribute to strengthen the current alternatives in favor of students with disabilities in the institution. In this sense, the model of Digital Accessibility Attention Unit is new in the system, requiring informed information, guidance, and training to initiate an adequate development of this strategy.

The implementation of the "1.1 Report on the state of the art of technological accessibility care units applied to Higher Education" and the "2. 1 Guide for the implementation and management procedures of a technological accessibility care unit applied to Higher Education", as well as the co-financing provided by the European Union through the EduTech project, has made it possible to mitigate this situation by initiating the planning of the Technological Accessibility Care Unit at the institute, cataloging the TecNM/ITA as a pioneer in the establishment of this type of support services within the national technological system.

The purpose of this article is to disseminate the EduTech project by encouraging the implementation of its deliverables once they are available. In this sense, section 2 summarizes the implementation of the "1.1 Report on the state of the art of units of attention to technological accessibility applied to Higher Education" and the "2.1 Guide for the implementation and management procedures of a unit of attention to technological accessibility applied to Higher Education" to integrate the unit of attention to digital accessibility of the TecNM/ITA, highlighting its functions in subsection 2. 1, and its organizational structure in subsection 2.2. Finally, section 3 presents the first conclusions obtained after the implementation of the findings derived from the aforementioned deliverables.

2. Integrating the Digital Accessibility Service Unit

The EduTech project made possible the integration of the support unit in the institute not only through the co-financing of the ERASMUS+ program of the European Union, but also through the results and recommendations of its deliverables "1.1 Report on the state of the art of support units for technological accessibility applied to Higher Education", and "2.1 Guide for the implementation and management procedures of a support unit for technological accessibility applied to Higher Education". The essential conduction of these documents made it possible to visualize the functions of the digital accessibility care unit, and its integration into the institute's organizational structure. The following preliminary statements for the unit's mission and vision have also been proposed.

- **Misión**, establecer una comunidad accesible donde los estudiantes con discapacidad tengan la misma oportunidad de participar plenamente en todos los aspectos del entorno educativo, promover la independencia de los estudiantes, y asegurar que los estudiantes sean reconocidos por sus habilidades y conocimientos por encima de su discapacidad.
- **Visión**, un ambiente educativo – incluyendo: Oportunidades y actividades educacionales; académicas; laborales; recreativas; sociales; y deportivas– en el Tecnológico Nacional de México /IT Aguascalientes universalmente accesible para todos los estudiantes sin la necesidad de intervenciones, adaptaciones, y/o diseños especiales gestionados por la unidad de atención a la accesibilidad.

En las siguientes subsecciones se describen las actividades correspondientes resaltando su estatus actual indicándose: en planificación, en desarrollo, o implementadas.

2.1 Funciones de la Unidad de Atención a la Accesibilidad Digital

Los fundamentos del estado del arte de unidades de atención a la accesibilidad tecnológica aplicada a la educación superior, y las recomendaciones de la guía de implantación y procedimientos de gestión de una unidad de atención a la accesibilidad tecnológica aplicada a la educación superior, permitieron identificar el siguiente conjunto de servicios de apoyo tecnológico para estudiantes universitarios con discapacidad:

- **Technological assistance to students with visual (partial), hearing (partial), and mobility disabilities** (IN PLANNING), through the equipment acquired with the support of the European Commission through the project "Technological assistance to accessibility in Virtual Higher Education", technologies will be developed to assist accessibility in accessible virtual education, including: accessible virtual campus, accessible open educational resources, accessible plugins for Moodle, and 3D work simulators. In addition, fifteen accessible workstations will be available for students with visual (partial), hearing (partial), and mobility disabilities who wish to use them to carry out academic activities in their face-to-face classes. Additionally, a strategy based on the promotion, design, development,

and implementation of curricular adaptations (Alcantud, Avila, & Asensi, 2000; Corredor Ponce, 2016) and reasonable accommodations (Ortego Hernando, 2000; Sandoval, Morgado, & Domenech, 2020) has been presented to the institute's authorities. This initiative that would be managed by the digital accessibility care unit involves the detection of students with disabilities during the enrollment process; the notification of teachers who would have such applicants as students; and the negotiation of curricular and reasonable accommodations based on available resources. A student volunteer service is envisioned as academic support for students with disabilities based on the Victoria University of Wellington (New Zealand) model. As well as strengthening the current academic tutoring program by incorporating accessible aspects to better serve students with disabilities.

- **Assistance to the distance education programs offered at the institute by incorporating accessibility aspects in virtual education** (IN PLANNING), the digital accessibility unit will collaborate with the distance education coordination of the Tecnológico Nacional de México / IT Aguascalientes to develop accessible technological elements (for example, plugins for Moodle), and implement them in the courses of the two undergraduate programs in the distance education modality that are currently offered.

- **Training for the institute's teachers in essential aspects of accessible virtual education** (IN PLANNING), through the digital accessibility unit, an accessible training program will be managed and carried out, initially for teachers and later extended to administrative personnel. Currently, a preliminary agenda has been designed to establish an accessible training program for the institute's teachers following the recommendations of the Guide for Accessible Training of those Involved in the Teaching-Learning Process in Higher Education, deliverable 2.5 of the project "Technological Assistance for Accessibility in Virtual Higher Education". The training is based on the sensitization of teachers to disability and accessibility (Bruder and Mogro-Wilson, 2010). The proposal will be reviewed by the institute's authorities and structured in accordance with current teacher training guidelines to formalize its delivery. It is also expected that this function of the digital accessibility unit will be intertwined with other initiatives that the Tecnológico Nacional de México is implementing at the national level, such as the Diploma in Inclusive Education.

- **Academic mobility for students with disabilities (**IN PLANNING), it is expected to work closely with the Department of Technology Management and Liaison to formalize specific agreements to ensure the mobility of students with disabilities, with industry, government, and foundations in the State of Aguascalientes. This activity would be complemented with the establishment of a specific process for the management of accessible mobility, which will cover from the dissemination of information to students, to the culmination of the stay.

- **Internships and internships in industry and promotion of academic employability for students with disabilities** (IN PLANNING), it is also expected to work closely with the department of Technology Management and Liaison to formalize specific agreements to ensure the proper conduct of internships and internships in industry; even considering the possibility of conducting virtual internships using the student's own equipment, or the accessible workstations of the digital accessibility unit. in this sense, the development of 3D work simulators is also envisioned as an alternative to promote the employability of students with and without disabilities.

- **Consulting for teachers and staff** (IN PLANNING), it is envisioned that the digital accessibility unit will be available to advise teachers of the institute who wish to implement accessibility strategies in their courses (e.g., curricular adaptations), as

well as to provide advice on accessible technology considering the aspects described in (Bruder & Mogro-Wilson, 2010).

- **To develop research projects in the context of technological assistance for accessibility in virtual education** (IN PLANNING), it is envisaged to take advantage of the equipment acquired through the project to carry out tests with users of the different accessible technological developments carried out by the digital accessibility unit. Both the developments and the results of the tests would be structured as research projects resulting in different types of scientific publications depending on the impact of the findings obtained.

2.2 The Digital Accessibility Attention Unit within the organizational structure of the TecNM/ITA

Similarly, the deliverables of the EduTech project, mentioned at the beginning of the article, helped to visualize the internal organization of the care unit and its proper integration into the organizational structure of the TecNM/ITA. The actions in this context are described as follows:

- **After several meetings with the institute's authorities, it has been determined that the technological support unit will be attached to the Academic Sub-Directorate (from which all academic departments and their programs of study at the institute depend) and will be integrated into the Distance Education Coordination Unit** (UNDER DEVELOPMENT). Currently, a couple of spaces have already been identified in the Distance Education building (whose construction was completed in May 2021), however, this is still being formalized by the institute's authorities. Similarly, it is being considered to make the care unit visible as a transversal service on the institute's website**.**
- **Work team and collaborators** (IN DEVELOPMENT, the initial work team integrates three professors with expertise in the following areas of knowledge: Professor 1: User experience, human-centered design, Human-Computer Interaction, educational technology, and accessibility. Professor 2: Serious game design and development, Virtual Reality, and Artificial Intelligence. Professor 3: Advanced web design and development, and virtual education platforms. The integration of an expert professor in Psychology and human behavior is also envisioned. This element is in the process of institutional formalization. Initially, only the profiles mentioned above are considered for the unit's work team. However, the external participation of experts in Sign Language (it is expected to have meetings with representatives of the National System for the Integral Development of Families, DIF Municipal, in Aguascalientes to discuss the project) and Braille (the Union of the Blind of Aguascalientes has been identified, linked to the ONCE Latin America Foundation, with whom it is expected to have meetings to discuss the project).
- **Quality assurance in the accessibility care unit** (IN PLANNING), we have chosen to implement the set of criteria suggested by The Quality Assurance Agency; because it is a reliable strategy with a large number of positive cases of implementation reported in the literature; in addition, it is compatible with multiple implementation scenarios. However, it is necessary for this alternative to be corroborated by the institute's authorities. Once the care unit is formalized, the self-evaluation commission will be formed, considering the participation of students with disabilities. It is envisioned that the self-evaluation will be carried out every six months. The first self-evaluation is expected to be carried out after the first semester with a record of the care and/or services provided by the attention unit. It is planned to hold meetings to analyze the results of the self-evaluation on the next working day after the self-evaluation is carried out.

3. Conclusions

This first approach to the establishment of a Technological Accessibility Attention Unit at the TecNM/ITA was very positive and generated interest in the national technological system. Likewise, it allowed corroborating the generality and easy implementation of the findings and recommendations from the deliverables "1.1 Report on the state of the art of technological accessibility care units applied to Higher Education", and "2.1 Guide for the implementation and management procedures of a technological accessibility care unit applied to Higher Education" of the EduTech project. Therefore, it can be inferred that it will be able to help other higher education institutions to set up their own technological accessibility care unit. In this sense, and as part of the EduTech project, it is expected to be able to confirm the above by replicating the exercise in the other Latin American partner universities of the project. This situation is important, since even though considerable progress has been made in the implementation of the attention unit, most of the actions are in the process of development and even in the planning process, preventing the visualization of a definitive implementation.

On the other hand, the exercise also revealed some critical aspects to be considered for a successful outcome. The first of these is undoubtedly institutional support; beyond the funding provided by the European Union, it was necessary to count on the willingness of the institute's authorities to generate specific processes (for example, the bidding process for the purchase of equipment), allocate space for the assembly of the technological accessibility unit, and manage specific actions of various departments and units of the institute (for example, financial resources, planning and budgeting, computer center, and material services). Another key element is to encourage the participation of teachers and students with and without disabilities in the strategy proposed through the mission and vision of the technological accessibility unit. Likewise, it is considered important to link with external associations, including government agencies, specifically focused on the attention to people with disabilities.

Acknowledgments

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Relational analysis of the graduation profile of the unified general baccalaureate and the academic offer of the Pedagogy in Experimental Sciences and Computer Science degree program

Análisis relacional del perfil de egreso del bachillerato general unificado y la oferta académica de la carrera de Pedagogía en Ciencias Experimentales Informática

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and the academic offer of the Pedagogy in Experimental Sciences and Computer Science degree program. *Revista Cátedra, 5*(1), 114-124.

Abstract

In the course of high school, Ecuadorian students take the exam Ser bachiller, a component that allows access to higher education, that is why this research focused on knowing the factors that affect the relationship of the graduation profile of the students of the Unified General Baccalaureate for the entrance to the Pedagogy Career in Experimental Sciences of Computer Science of the Faculty of Philosophy, Letters and Educational Sciences at the Central University of Ecuador. Non-experimental research was carried out, with a field approach, at a descriptive level, using quantitative methodology, data was collected; in addition, a test was conducted, which worked with the students entering the career as essential informants and data was processed using SPSS 23 statistical software. Among the main findings, it was evidenced that the students graduated under the BGU program of study evidence certain deficiencies before the demands of the entrance profile required by the Central University of Ecuador, also that the skills and abilities acquired by the BGU students are elementary, and the expectations that the students reach the level of excellent achievement is scarce; decreasing the possibilities of entering higher education.

Keywords

Unified general baccalaureate, computer science, academic offerings, entrance profile.

Resumen

En el transcurso de la secundaria los estudiantes ecuatorianos se presentan al examen Ser bachiller, componente que permite el acceso a la educación superior, es por ello que la presente investigación se enfocó en conocer los factores que inciden en la relación del perfil de egreso de los estudiantes de Bachillerato General Unificado para el ingreso a la Carrera de Pedagogía en Ciencias Experimentales de la Informática de la Facultad de Filosofía Letras y Ciencias de la Educación en la Universidad Central del Ecuador. Se ejecutó una investigación no experimental, con enfoque de campo, de nivel descriptivo mediante la metodología cuantitativa se tomó datos; además se realizó un test, mismo que trabajó con los estudiantes que ingresan a la carrera como informantes esenciales y se procesó datos mediante el software estadístico SPSS 23. Entre los principales hallazgos se evidenció que los estudiantes graduados bajo el programa de estudio del BGU evidencia ciertas falencias ante las exigencias del perfil de ingreso que requiere la Universidad Central del Ecuador, además que las habilidades y destrezas adquiridas por los estudiantes del BGU son elementales, y las expectativas que los estudiantes alcancen el nivel de logro excelente es escaso; disminuyendo las posibilidades de ingreso a la educación superior.

Palabras clave

Bachillerato general unificado, informática, oferta académica, perfil de ingreso.

1. Introduction

Access to education is a right in Ecuador (Constitution of the Republic of Ecuador (2008), and offering quality education with skills for the workplace and personal development is a priority for the United Nations and UNESCO. In this sense, the country has established state policies that are currently necessary and that promote a better competitive education, however, the lack of competencies presented by students at the secondary level are due to the error in the educational system, as asserted by (Terán et al., 2016, p.42).

In the search for educational quality, the country has mistaken its objectives by overloading the teacher with work mostly in the administrative aspect over the needs of the student, making this focus on the need to comply with the work requested by the authorities, leaving aside the primordial which is the education oriented to students; maintaining a unified general high school, which shows absolutely the opposite of what was expected. Such is the point that, if in 2017 Ecuador participated in the PISA D tests trying to reach the average of the tests, in 2018 according to the director of the National Institute of Educational Evaluation (INEVAL) it was decided not to participate and wait to perhaps be able to participate in the 2024 tests (Rosero, 2019).

Aligned to the above, a call is made to make the necessary changes in secondary education that needs to rethink the subjects and content of the Unified General Baccalaureate (BGU), in addition to the time assigned to them; because it is not how much a subject covers but the quality of it and above all that the knowledge is accurate for the student. Ecuador, being a third world country, faces problems in education on several fronts, the first being social segregation in urban versus rural areas. In urban areas there are different limitations such as access to certain resources such as computers, internet, laboratories and even in spite of being in an area where it is believed that there should be no shortages; these types of limitations still persist, but most of the problems arise within the education system.

In 2013, INEVAL was created, which has as its occupation to cause the educational quality through the educational system that is executed at the moment. Seeking in the student to show the learning achievements as fundamental indicators for the quality and educational performance; but essentially to establish the foundations for the development of a country.

Since 2014 the tests to be a bachelor in Ecuador are presented with the aim of determining the level of knowledge in basic areas such as Mathematics, Language and Literature, Natural Sciences, Social Sciences, same that according to INEVAL (2018)

> The Ser Bachiller exam contributes 30% to the final grade for graduating with a bachelor's degree, the average obtained in the upper basic sub-level contributes 30% and the average of the three years of baccalaureate with 40%" these last two correspond to the final graduation grade. Therefore, it is imperative that the graduation profile of students in the last years of high school be aligned with the guidelines set forth in the Ser Bachiller tests (p. 11).).

Every year, secondary school students graduate and aspire to continue their student life in higher education, but these aspirations are often stalled by shortcomings in the knowledge acquired previously and the educational profile that higher education requires. It is here where it is necessary to match the actions that occur in the two areas and to know how much one influences the other.

Currently in Ecuador, the INEVAL establishes the elementary level as achieved, in terms of the Ecuadorian baccalaureate, that is to say, it only meets the basic expectations. In the future, if education continues in the same way, it will not be able to train high school graduates different from the one currently being trained. And if the demands are higher, education will decline. That is why the BGU, no matter how pompous it may sound, will not provide a solution; the alternative is to improve what we are doing wrong. The alternative is to improve what we are doing wrong, and that the expectations of the educational level reach more competitive levels.

Accordingly, this study seeks to know some edges to determine the relationship of the graduation profile of the students of the Unified General Baccalaureate for the entrance to the career of pedagogy in Experimental Sciences of Computer Science of the Faculty of

Philosophy, Letters and Educational Sciences at the Central University of Ecuador. For this purpose, the following specific objectives are established:

- To diagnose the skills acquired by students during the unified general baccalaureate in the areas evaluated by the baccalaureate program.
- Determine the relationship between the skills of the entrance profile for higher studies to the Pedagogy in Informatics career and the graduation profile of the Unified General Baccalaureate that allows access to the university.
- To establish the level of knowledge that students have in the subjects of the common core to enter the pedagogy career in computer science.

Consequently, the study is structured in the beginning of illustrations concerning the baccalaureate in its basic aspects, in addition to formative experiences about the BGU, after which concepts and definitions are presented in relation to the unified general baccalaureate. Consequently, the methodology used during the research design is presented, which contains a quantitative field approach, with documentary support and explanatory level, followed by the results obtained, and finally, the conclusions are presented.

2. Theoretical Foundation

According to the Ministry of Education, the exit profile is defined on the basis of three fundamental values: justice, innovation and solidarity, and establishes, around them, a set of capacities and responsibilities that students must acquire during their transit through compulsory education (...) written in the first-person plural, so that students may appropriate it and take it as a reference in their daily work in the classroom (Ministry of Education 2019). On the other hand, the entry profile or coverage is the supply capacity achieved by an educational system to satisfy all social demand, in all school grades and in all geographic spaces of a country. Coverage relates the number of students enrolled to the total number of young people of school age and with the option of pursuing basic, secondary and high school studies.

Research conducted at the Latin American Faculty of Social Sciences -FLACSO Ecuador by Santana (2015) explains the causes for the implementation failures in the high school education policy in Ecuador, starting with the LOEI 2011. The study focuses on public policy failures, the failure of governance, the failure of the State mainly. In this sense, they establish that it is important for the government in office to focus its support on education as a priority, and thus establish parameters to show improvements in the education system. To deliver to society graduates with knowledge adequate to the needs of society, but this will not be achieved if economic funds are not distributed equally and not only focused on certain sectors.

Educational results come from several factors: formal education, natural ability, family background and education, and the situation of deprivation, poverty or exclusion. The results of formal education are evidenced in efficiency and equity. Efficiency is the capacity of the education system to promote students entering a level within a given time frame in a higher proportion. Equity is related to the distribution of results, i.e. a poor population is associated with worse results, and therefore with worse income.

When mentioning that the government intends to homologate the knowledge of Ecuadorian students and thus avoid knowledge spillover, different appreciations are presented than those expected. Thus showing an inequality of goals achieved and objectives to be achieved, dispersed in time and even in space. At present, teachers do not focus on the student and what they teach; moreover, the teacher's work has a greater administrative burden, making them not focus on the student.

The government's objective is to achieve uniform knowledge, but this has not been reflected in Ecuador's high school graduates. It is even more difficult to believe that the high school student in the east of Ecuador has the same needs as the one in the city. The realities of each of them are different, since the needs and opportunities change depending on the place where they are located. As a conclusion in the above-mentioned research, it is intended to capture the environment that encompasses education and particularly the unified general baccalaureate and its contribution to students in their transfer to higher education, determining asymmetry by wanting to add importance in the political and in the programmed making it diffuse and ambivalent affecting this system directly. The states, being immersed in the figure of educational improvements, do not adequately reflect the deconcentrated management model and thus diminishes the value of those involved in it, such as teachers, educational authorities and even the students themselves.

This leads to the conclusion that the proposed educational system does not respond to the exit profiles projected for Ecuador's high school graduates. These statements contributed to make improvements in the curriculum presented in 2016, also showing that it is necessary to take into consideration what one of the directors of the PISA tests emphatically catalogs that are right because the major drawback that Latin America has in education is focused on curriculum reform and are purely by design. Educational reforms should be carried out based on the realities that exist in the country, and not focused on foreign realities.

In education there is much discussion about improvements in both quality and infrastructure, which is why the Information System of Educational Trends in Latin America (SITEAL) in the document extracted from the Base of regulations and policies on the New Ecuadorian High School of the Ministry of Education updated to December 12, 2018, whose objective is the restructuring of curricular reforms designed in 2008 focuses a thorough review on the 2010 reform to improve education in Ecuador with emphasis on the second level of education as is the High School. In the opinion of the research, it is there where concrete reforms should be made, focusing on the student and the needs of society today. Improvements that will be presented when the Ecuadorian citizen finishes high school, and the different ways that must be presented upon graduation. That is to say, the Ecuadorian high school graduate should focus on pursuing a higher education career, but if for other reasons he/she must enroll in the workplace, he/she should be able to do so without any inconvenience.

According to SITEAL 2018, in order to perform the formative, training and propaedeutic functions, the curriculum of the baccalaureate must be well articulated with the labor demands of the different productive sectors, universities and other higher education centers, so that there is no excessive rupture between one and the other. Likewise, it is necessary that the high school graduate interested in entering university is not limited in his or her options as a result, precisely, of a premature and exaggeratedly fragmented specialization, for which it is imperative that his or her training has been sufficiently generic so that no option for higher studies is excluded (p. 10).

The educational system aims to respond to the needs of today's society, and thus remedy the problems that the baccalaureate presents. One of the main drawbacks is the different approaches presented by the curriculum in the educational system, exposing a dispersion in relation to what is proposed; starting from the "competency" approach versus the "content approach". If homologation in education is sought, the approaches should be the same.

The problems externalized in the curricula of 2008, and in the updating and strengthening of the curriculum of March 2010, showed that students in Ecuador faced problems such as

socioeconomic inequalities, lack of guarantees of equal opportunities, educational dualism, among others, after graduating from high school. There have been countless meetings, debates, congresses, lectures, but to tell the truth the fruits that these have generated have been little fruitful; in the improvements that education should have. These disadvantages are not effects that are concentrated in secondary education, but are dragged to higher education, which is why a new reform is being considered, these would not be unprecedented since there are constant debates in Latin America on education by "generalities" and "specialties".

3. Methodology

The following is a general description of the methodology used during the research, for which the research design, population, sample and research techniques and instruments are determined.

3.1 Research design

The research conducted responds to a quantitative study, with a transversal non-experimental design and explanatory scope whose intention was to establish the contribution of the unified general baccalaureate in students, who intended to enter higher education within the Faculty of Philosophy Letters and Educational Sciences of the Career in Pedagogy in Computer Science in the leveling students in the period October 2019-March 2020.

The main variables of the study are described in Table 1 below:

Variable	Dimensión	Indicadores	Ítems
The graduation profile of unified general baccalaureate students	Cognitive area	Logical Reasoning Mathematics Language	1.1, 1.2,1.3,1.4,1.5,1.6
	Procedural area	Social environment Natural Science Select	1.7,1.8,1.9 1.10,1.11,1.12 1.13,1.20
	Axiological area Knowing how to be	Analyze Complete Hierarchize Respect Solidarity Honesty	2.14, 2.15, 2.16,2.17, 2.18,2.19, 3.21,3.22,3.23 3.24 3.25, 3.26
Admission to the pedagogical career in experimental sciences in computer science.	Entry profile to the computer science career.	Investigative Argumentative Responsible Critical	4.27, 4.28,4.29, 4.30,4.31,4.32 4.33, 4,34,4.35 4.36, 4.37
	Knowledge	Logical Reasoning Language N.N.C. CC SS Attempts for university entrance. Exempted tests	5.38,5.39 5.40, 5.41 5.42,5.43 5.44, 5.45 6.46,6.47 6.48,6.49 6.50, 6.51
	Admission policies	Minimum score Placement	

Table 1. Operationalization of the variables studied

3.2   Population and sample

The population consisted of 51 students attending the morning and afternoon sessions of the Faculty of Philosophy, Letters and Educational Sciences of the Universidad Central del Ecuador, of whom 60% were male and the remaining 40% female. According to age, 76% were between 20 and 21 years old, and 52% of the students were part of the unified general baccalaureate program.

3.3   Research techniques and instruments

For the collection of the data referred to the variables described, a questionnaire survey was used with questions measured on a Likert scale and designed under specific procedures of the discipline under investigation. The instrument consisted of 51 questions, divided by logical, linguistic, scientific and axiological domain constructs, each construct comprising three questions adapted to the Likert scale in a range of 5 to 1 where 5 is the highest range.

The instrument was previously submitted to a reliability analysis for which a pilot test was used with 10 students of the Pedagogy Career in Experimental Sciences of Computer Science, morning section, with similar characteristics to the sample under investigation. The pilot test was used to highlight the errors that were present in the instrument itself, which was carried out with a face-to-face survey; after the pertinent changes were made, it was subsequently applied to the entire population. In this sense, a cronbach's alpha coefficient of internal concordance of 0.831 was obtained for the items, which represents a high reliability.

4.   Results

Descriptively, the sample is composed of 40% women and 60% men, with 48% in the age group between 20 and 21 years, followed by 28% between 18 and 19 years, and finally 24% of the students between 22 and 23 years of age. In the Pedagogy of Experimental Sciences and Informatics career, 52% of the students have a unified general high school diploma, followed by 44% of the students with a technical high school diploma, and 4% with a bachelor's degree in specialties or other. Of the group surveyed, 26 of the 52 students graduated from secondary school with a unified general baccalaureate, and 22 students obtained a technical baccalaureate. And 4 students obtained another type of baccalaureate. A summary of the results obtained by the dimensions of each of the objective variables is presented below.

Graduation profile of the students of the unified general baccalaureate.

Dimension cognitive domain in reference to the graduation profile of the BGU students in the cognitive domain show deficiencies in logical and mathematical reasoning, since half plus one answered incorrectly and the remaining forty percent were correct, the rest did not answer. Linguistic proficiency in the students is better in half plus one showing adequate skills in the handling of literature. In addition, less than a quarter of the students adequately mastered the subject of social studies. The same that allows showing an average of 48% of correct answers. Given the values, there is evidence of great cognitive weaknesses in the indicators of logical, mathematical, social and natural reasoning in the students participating in the unified general baccalaureate program.

In order to know if the higher skills were acquired by the student, the corresponding process was carried out, which showed that an average of 38% of the students acquired the higher skills. In addition, when the students were asked about the cognitive domain together with the procedural domain, it became evident that less than half of the respondents responded adequately to the questions when these were shown together.

During this process there is superiority in terms of the elements within the topics covered by the survey, which is why when the cognitive and procedural dimensions were grouped together, the results were less than half but two.

Dimension axiological scope in relation to the axiological determinations in the student in this regard, the respondents agree with the items formulated, in terms of honesty they maintain positions on the scale of agreement and in terms of solidarity, the students surveyed frequently agree very much. It is relevant to mention that the practices within the axiological scope are reflected within the range of good without reaching the level of very good on the perspectives they have in this aspect.

In the investigative area, half but one of the students answered that they investigate autonomously, in addition, a quarter but one investigates when they do not know about a topic, and 34% of the students consider that they are argumentative almost always. The level of responsibility of the student was only 28%, which always shows responsibility according to the expectations of the career. As to whether the student is critical during a class, the informants responded that sometimes they are critical (38%) during a class.

In the Knowledge dimension, the subjects covered within the knowledge dimension were the same as those contained in the cognitive dimension, similar aspects that are measured in the evaluations of the baccalaureate exams. The average of correct answers reached only 10.25%, showing that most of the students surveyed have great weaknesses in terms of the knowledge acquired.

Regarding the dimension Admission policies, the admission policies generate dissatisfaction among the students, because the great majority have tried more than once to reach the required score to opt for admission to higher education and others do not remember the times they have tried. The minimal contribution that the unified general baccalaureate program represents means that all students have to take the leveling semester before going to the first semester of their degree program. In theory, the leveling should be useful for a successful start to the career, however, more than a quarter of the informants believe that the leveling period does not represent adequate help. On average, 40% of the students consider that the exonerating test does not help them to pass the leveling semester since it covers subjects with a high level of complexity. For the general correlation, the graduation profile of the students of the unified general baccalaureate was determined by means of variable one or independent variable; and variable two or dependent variable, the entrance profile.

With respect to the entrance to the Pedagogy Career in Experimental Sciences of Computer Science in function of the graduation profile of the BGU, it was determined that there is a not very significant inverse correlation between the variables with a value of -0.136. This leads to the acceptance of hypothesis two, which falls into the null hypothesis (H0) The graduation profile of the students of the unified general baccalaureate does not provide sufficient bases to enter higher education. In addition to the general correlation, the dimensions of the operationalization of the procedural variables were analyzed with the entry profile to determine if there is a relationship with the indicators. Accordingly, the correlation coefficient between the entry profile of the computer science pedagogy career in the procedural area and the graduation profile of the students of the unified general baccalaureate was 0.986. Evidencing a high level of correlation affirming the needs of higher education in terms of the procedural area of the baccalaureate, on the skills that should be presented and their ability to select, analyze, and even hierarchize; skills acquired by the student during his passage through high school, are high and constitute an advantage for the entrance to the career.

This result proves that what is acceptable in the BGU are the relationships that exist between Pre-entry and the procedural area, accepting the hypothesis that the skills acquired in the unified general baccalaureate are not elementary, and contribute to the profile for entry into higher education.

5. Conclusions

The research essentially sought to determine the relationship between the graduation profile of the unified general baccalaureate and the entrance profile to the computer science career, which had as its main population the students in the first semester of the career.

In relation to the specific objective one, which sought to diagnose the skills acquired by the students during the BGU, it was determined that 52% of the students have deficiencies in the cognitive area such as logical reasoning, mathematics, social studies and natural sciences. It is necessary to mention that the only strength was evidenced in the area of linguistic domain with 60% of assertiveness.

This contrasts with Tamayo (2019) in his research called "Educational System of Ecuador: one system, two worlds" where he mentions that if the tests were complicated in 2008 when 4 out of 10 students failed the entrance tests(..) "This was further aggravated with the change of the tests from abstract, numerical and verbal reasoning of the first application of the exam in 2012 (SENESCYT, 2015) to its current version as a knowledge exam.

In relation to specific objective two to determine the relationship between skills of the higher education entrance profile and the graduation profile of the unified general baccalaureate that allows access to university. It was concluded that the skills developed during the BGU barely reach the level of criticality that is required, the low level of responsibility and argumentativeness is also evident, i.e. the expectations of the entry profile are high and the skills developed are low.

In comparison with Ortiz (2017), during their research: "Experiences in the Central University of Ecuador" (p. 50) determined that, in the FJCPS, the ability to think in critical mode had as results 44%, 44%, and 44% during three periods. In FAU, the ability to think critically had as results 33%, 50%, and 58% in the three periods it is important to mention that the results shown are results obtained in different faculties, obtained in the leveling course from 2012 to 2015. (p. 48).

In relation to the specific objective three, to establish the level of knowledge that students have in the subjects of the common core to enter the Pedagogy in Computer Science career. It was found that the level of knowledge in the areas of logical reasoning, mathematics, language, social studies and natural sciences is low. In relation to the high expectations that the Ministry of Education stated would be reached with the incorporation of the unified general baccalaureate to the educational system, it was found that the level of knowledge in the areas of logical reasoning, mathematics, language, social studies and natural sciences is low.

Regarding the research of the aforementioned authors on establishing the level of knowledge possessed by the students. In the subjects of the common core for the entrance to the career it is evidenced that logical reasoning is not a subject adequately achieved. and others that were presented within the research that concludes that it should be reinforced in the development of thinking and logical reasoning, in certain faculties of the studied oral and written skills in addition to verbal reasoning. There is also evidence of high percentages of correct answers in certain periods and low percentages in others.

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Inclusion in times of pandemic: The advantages and difficulties of virtual education for students with functional diversity

La inclusión en tiempos de pandemia: las ventajas y las dificultades de la educación virtual para los estudiantes con diversidad funcional

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Abstract

By the second half of March 2020, the leaders of many nations took drastic measures - isolation, closures and curfews - to stop the covid-19. One of the sectors most affected by these decisions was education: from preschool to university level. Faced with the cancellation of face-to-face classes, university institutions -prepared or not- opted for virtual education in order to save their finances and avoid student desertion. In spite of the difficulty of its implementation in the classroom, this modality has become very popular. This research arises from the need to examine the advantages and difficulties of virtual education for both typical students (those who do not have difficulties) and those who have some impediment during these last months. Likewise, the impact -favorable or adverse- of virtual education on the inclusion of students with functional diversity will be analyzed. Throughout this article, definitions such as virtual education, impairment, functional diversity, inclusion, reasonable accommodation/modification, and universal design will be provided. Finally, recommendations for incorporating universal design into online courses and what the future of education looks like in times of pandemic will be offered.

Resumen

Para la segunda quincena de marzo de 2020, los dirigentes de muchas naciones tomaron medidas drásticas —el aislamiento, los cierres y los toques de queda— para detener el covid-19. Uno de los sectores más perjudicados por estas decisiones fue la educación: desde el nivel preescolar hasta la universitaria. Ante la cancelación de las clases presenciales, las instituciones universitarias —preparadas o no— optaron por la educación virtual con miras de salvar sus finanzas y evitar la deserción estudiantil. Pese a lo atropellado de su implantación en las aulas, dicha modalidad ha cobrado gran vigencia. Esta investigación surge de la necesidad de examinar las ventajas y las dificultades de la educación virtual tanto para los estudiantes típicos (no poseen dificultades) como para los que poseen algún impedimento durante estos últimos meses. Asimismo, se analizarán las repercusiones —favorables o adversas— de la educación virtual en la inclusión de los alumnos con diversidad funcional. A lo largo de este artículo, se brindarán definiciones tales como educación virtual, impedimento, diversidad funcional, inclusión, acomodo/modificación razonable y diseño universal. Por último, se ofrecerán recomendaciones para incorporar el diseño universal en los cursos en línea y cómo se vislumbra el futuro de la educación en tiempos de pandemia.

1. Introduction
1.1 Historical background

On December 31, 2019, when many citizens around the globe were in preparations to welcome the new year, the Wuhan Municipal Health Commission (Hubei Province, China) notified about a cluster of pneumonia cases in the city. Later, "they are determined to be caused by a new coronavirus" (World Health Organization, 2020, para. 1).

Initially, it was assumed that "the epidemic outbreak could be controlled locally in China" (Serrano-Cumplido et al., 2020, p. 56). Perhaps the geographic remoteness between China and our America may have created a false sense of confidence that this virus would be delayed or would never reach our seas. In the light of truth, it was not the first time in recent times that epidemics have occurred in remote places that, fortunately, never reached our countries (e.g. Ebola) or did so in a rather contained manner since they could be contained relatively quickly.

After three months, on March 11, 2020, the WHO declared a state of pandemic in view of the progressive expansion of the epidemic at the international level. By the second half of March 2020, the leaders of many nations felt that drastic and rapid measures had to be taken to stop the five-letter, two-numbered monster, covid-19. Therefore, on March 15, 2020, "the then governor of Puerto Rico, Licenciada Wanda Vázquez Garced, signed an executive order decreeing a curfew to curb the spread of covid-19" (Pascuas, 2020, para. 1). He also reported the cessation of the functions of governmental and educational entities (schools, colleges, institutes and universities), and of businesses, with the exception of essential services such as restaurants, supermarkets, pharmacies and gas stations, among others.

Many countries closed -totally or partially- their borders to foreigners and opened them only for people in exceptional situations, but with requirements such as a negative covid-19 test and quarantines of different lengths. Within these terrible circumstances, it is discouraging that neither essential sanitary measures (e.g. constant hand washing, the use of hydroalcoholic gel, masks and social distancing) nor mass vaccination in some countries -such as Puerto Rico- have managed to put a stop to this virus. It should be noted that this virus has been transmuting into multiple variants (e.g. delta, delta plus, lambda and omicron, among others) that are increasingly resistant and easily transmitted. In fact, a series of outbreaks have been triggered by high vaccination rates. It should be noted that immunization does not prevent contagion, but rather reduces the severity of covid-19 symptoms (e.g. fever, fatigue, headache, cough and congestion, among others).

An aggravating factor for our countries is that "21% of the urban population lives in slums, informal settlements or substandard housing, where overcrowding and lack of basic services are some of the factors that create an environment particularly conducive to the spread of the disease" (Organization for Economic Cooperation and Development, 2020, para. 6). Despite these obstacles, some segments of the population - particularly in the 20-40 age range - have misconceptions and/or misinformed notions about the virus (e.g., covid-19 does not exist, the virus is a hoax invented by pharmaceutical companies for profit, it is a strong flu, vaccines are not safe, "you have to die of something" and "it won't touch me") and act unthinkingly, ignoring the restrictions imposed by governments in pursuit of the common good. Of course, one cannot ignore the fact that taking care of oneself is a responsibility that falls on each individual.

Prevention and the instinct of self-preservation must prevail without punitive actions (e.g. fines, sanctions, imprisonment and closure of premises, among others) by the State. Even so, reckless behavior has often led to the prolonged hospitalization, death or infection of children under 12 years of age (who have only recently gained access to the Pfizer or Soberana vaccine, depending on the country of residence) or the elderly with compromised health. To this day, hospitals are still overcrowded with covid-19 patients. In such circumstances, there have been instances in which patients with chronic and serious conditions have been left behind due to lack of beds and equipment. Within this bleak picture, front-line workers such as doctors, nurses, first aid workers and cleaners could not and cannot cope with so many patients. This overcrowding has resulted in a growing need for "health workers" who have become scarce. Many have died and continue to die daily in the service of their fellow man.

In addition to the health risks, covid-19 "has had a major socio-economic impact on the Latin American region which was already facing structural difficulties" (OECD, 2020, para. 3). The containment measures profoundly affected supply and demand in many sectors such as tourism, which suffered countless postponements and cancellations. As a result, incomes in many households were reduced, unemployment increased due to permanent business closures, and inequality was exacerbated. In addition, domestic violence, child abuse and mental health problems have skyrocketed.

Both the isolation and the uncertainty caused by the covid-19 pandemic have altered, to a greater or lesser degree, the daily lives of millions of people around the world. There is now talk of a "new normality" to which there is no choice but to adjust. One of the most affected sectors was education: from preschool to university. Thousands of students were waiting for a grade, a promotion or a diploma with a view to their academic and professional future. Thus, the covid-19 pandemic forced higher education institutions to postpone face-to-face classes and abruptly replace them with purely virtual semesters. It was necessary to act with haste because university finances and student retention rates were at stake, among many other factors.

With respect to Latin American universities, the levels of preparation for this monumental, hurried and rushed transformation varied from institution to institution. Such a gap, in the words of Rama (2016), "is due to the fact that Latin America shows a high degree of heterogeneity and differentiation in distance education" (p.1). Rama (2016) adds that "it ranges from countries with low or non-existent levels of development to countries with education systems with a high presence of virtual education" (p.1). Since the end of the twentieth century and the beginning of this one, many university centers, inside and outside Latin America, have been gradually moving towards the increase of virtual offerings. This evolution has a budgetary impact because universities must invest in the purchase of equipment, improvements to the physical/technological infrastructure with its corresponding maintenance, the recruitment of experts (internal and external), the continuous training of administrators, professors, non-teaching employees and students. These changes in teaching modalities entail curricular revisions, search for new techniques and methodologies that could have an impact on the licensing and accreditation processes of the institutions.

Prior to the covid-19 pandemic, potential students were already faced with a wide range of university centers throughout the world with e-learning alternatives. This offer extends to undergraduate studies, graduate studies (master's degrees, doctorates and certifications), continuing education and even includes free courses. Some have totally virtual courses (e.g. the Universidad Nacional de Educación a Distancia de España and the Universidad Tecnológica de México), others have a considerable number of online study programs (e.g. the Universidad Nacional Autónoma de México and the Universidad Interamericana de Puerto Rico) and others have a robust offer of virtual courses (e.g. Harvard University and the Massachusetts Institute of Technology), while others have a large number of online courses (e.g. the Universidad Nacional Autónoma de México and the Universidad Interamericana de Puerto Rico) and others have a large number of online courses (e.g. Harvard University and the Massachusetts Institute of Technology).

Although there were already many advances in this direction, there were still many universities in Latin America whose offerings were predominantly face-to-face. At that time, prior to March 2020, student selection was based on personal tastes and particularities (e.g., budget, employment, marital status, location relative to the institution, and special needs, among other factors). After the first eleven weeks of 2020 and, in the midst of the uneasiness that gripped every sector of educational institutions at all levels, virtual education emerged as an option - exclusive and mandatory - to finish the academic year and protect themselves from the deadly virus. Overnight, administrators, teachers, students and support staff had to adopt e-learning as a literal subsistence measure with its benefits and challenges.

This research sets out to investigate primarily the merits and disadvantages of e-learning for functional diversity. First, these will be examined in light of recent articles. Using the data from these papers, a questionnaire on the advantages and difficulties of virtual education during the covid-19 pandemic was drafted. It was administered to 133 students, both typical and impaired, from the University of Puerto Rico (Río Piedras Campus). Its results are presented in order to corroborate the validity of the studies cited. These pages conclude with the effects -favorable or adverse- of virtual education on the inclusion of students with functional diversity and with recommendations to promote it within e-learning.

1.2 Some relevant terms

Before moving on to any other considerations, it is necessary to clarify some terms that will come up repeatedly in this paper. These are: impairment, functional diversity, inclusion, reasonable accommodation or modification, and universal design. The Dictionary of the Royal Spanish Academy (2021) defines the word impediment as "obstacle, embarrassment

or hindrance to something" (Impedimento, para. 1). Michael Bérubé, an expert in impairment studies at Pennsylvania State University, explains that the term impairment "names myriad human conditions and varieties of dysfunction, from mild to severe, from imperceptible physical disability to inexplicable developmental delays. It is a category whose constituents are inherently contingent" (1996, p. 52). The Puerto Rico Charter of Rights of Persons with Disabilities (2004) calls a "person with disabilities" "any person who has a physical, mental, or sensory impairment that substantially limits one or more essential life activities; has a history or medical record of physical, mental, or sensory impairment; or is regarded as having a physical, mental, or sensory impairment" (Article 2, para. 8).

Beyond any definition (although some make it possible to obtain services or legal protection) of the many that are available or any label attributed to persons with disabilities, they have many faces, many voices and many identities. One can speak of a diversity within diversity because an impairment can be observed in an individual regardless of race, color, gender, religion, nationality, age, education, social class, etc. Similarly, an impairment can be observed in an individual regardless of race, color, gender, religion, nationality, age, education, and social class, among others. Likewise, an impairment may be congenital or acquired; permanent or temporary; or visible or imperceptible. On the other hand, the Digital Accessibility Unit of the University of Alicante (Spain) states on its website that functional diversity is understood "as the phenomenon, fact or characteristic present in society that, by definition, would affect all its members equally" (2021a, para. 1). It emphasizes that "university classrooms are full of students from different conditions: from diverse populations from the surrounding area, or even from abroad, such as students; of different faiths, with diverse economic situations, elite athletes, students with student representation and also with different health conditions" (2021b, para. 1).

In line with this assessment, it is added that "in society, there are people with diverse or different abilities or functionalities" (2021a, para. 1). It indicates that functional diversity "is not an alternative term to 'disability' or 'impairment', but a term for exclusions or discrimination" (2021a, para. 2). It points out that "in today's society, there is a tendency to adapt the environment and public spaces to the needs of persons with disabilities, in order to avoid social exclusion, since a disability is perceived as such when the person is unable to interact with his or her own environment by him or herself" (2021a, para. 3).

The term functional diversity is often linked to the universal right to inclusion. Network Learning (2021), an organization of management volunteers in the Netherlands elaborates on the meaning of inclusion as:

> ...the recognition of our universal "oneness" and interdependence. Inclusion is the recognition that we are "one" even though we are not the "same". The act of inclusion means the struggle against exclusion and all the social ills that exclusion gives birth to, racism, sexism, and so on. The struggle for inclusion also involves ensuring that all support systems are available to those who need such support - as a civic responsibility, not a favor (paras. 2-3).

Parallel to this line of thought, the United Nations Educational, Scientific and Cultural Organization (UNESCO) states that for education to be inclusive, it must "remove barriers to the participation and achievement of all learners, take into account the diversity of their needs, abilities and particularities, and eliminate all forms of discrimination in learning" (n.d., para. 4). According to the Inclusive Education page (2006), inclusion means "enabling all students to participate fully in the life and work of communities, regardless of their

needs. It is the process of increasing student participation...and reducing exclusion from cultures, curriculum and community" (para. 10).

In relation to reasonable accommodation, Article 2 of the Comprehensive Educational Services for Persons with Disabilities Act of June 7, 1996 (Puerto Rico) states that it "consists of the modification or adjustment to the educational or work process or setting that allows the person with disabilities to participate and perform in that environment" (para. 2). Some examples of reasonable accommodations -many pre-pandemic- are: seating location, a recess, the company of an assistant (tutors, readers or interpreters) and a service dog, tape recorders, technological assistance and differentiated assessment. During these times of virtual education, some of the accommodations have evolved. Among these, we can list: documents with the ability to be read by screen readers (preferably, in the original format in which they were generated), the description of images (both in online classes and in documents that are placed on educational platforms), videos must contain closed captions, and the programming of educational platforms to provide additional time for exams.

Another term linked to this work is universal design. In its initial meaning for architecture and for construction, universal design stipulates the following principles (which have gradually been incorporated into other areas): equality of use; flexibility; simple and functional use; understandable information; tolerance for error; low physical effort; and space and size for approach and use (Accessible City Corporation, 2012, paras. 7-13). Within the field of education, there are several approaches to universal design that, with all their similarities and differences, coincide in the same purpose -education for all- since regardless of whether it is universal design for learning, universal design for instruction, instructional universal design or universal design in education...measures based on universal design are being implemented in the university community, and these are beneficial for students with disabilities, but also for those students who do not present, a priori, any difficulty in their teaching and learning process. It is, therefore, the task of educational administrations, universities, and professors themselves, to rethink their teaching practices from a proactive paradigm such as universal design applied to higher education (Sánchez Fuentes, 2016, p. 29).

After having provided the historical framework and relevant terminology, the advantages and difficulties of virtual education for students with functional diversity will be examined. First, studies of the last years around the topic will be reviewed to move on later with the questionnaire administered to the students with their corresponding results.

2. Materials and methods

2.1 Literature review

Since before the pandemic, the following benefits of virtual education were mentioned: saving time and money; flexibility; being able to take the class from anywhere, continuous access to course materials, and the use of information and communication technologies (e.g. educational platforms, videos, chats, blogs and e-mails). Regarding potential students with disabilities, Cortés Díaz (2020) stated in the article Educación virtual, una alternativa para población en discapacidad in the newspaper El Tiempo that "the virtual process would be an alternative to address the problem of access to education for people with disabilities, since their condition often prevents them from going to educational centers" (para. 4). Now, in the midst of the pandemic, there is an added merit and the fundamental reason for going virtual: to prevent covid-19 from continuing to spread and claiming lives. Even so, it is not the same to choose virtual education after careful reflection as to be suddenly plunged into a world like the one anticipated by Hanna Barbera's The Jetsons almost sixty years ago. Martínez Uribe (2008) points out that "for the development of virtual education, one must

consider: time, place, space, interaction, technology and self-control" (p. 25). It is evident that, for the most part, those teachers and students in the face-to-face modality did not have a transition period to take the necessary steps to enter fully into virtual education. While virtual education can be of enormous benefit to some individuals, there are many elements that need to come together to make it flow as smoothly as possible. Online courses are not without their stumbling blocks and frustrations for both teachers and students. Among the difficulties of virtual education that were already present prior to the pandemic are: the absence of an adequate technological infrastructure (equipment and a robust Internet connection); the lack of technological skills; the demand for discipline and planning; distractions; and limited interaction (teacher-student and student-student).

The coronavirus brought additional complications to the already existing ones (which were aggravated) such as the lack of differentiation between home and educational spaces; exposure to long working days with electronic devices; sedentary lifestyles; and understanding the new paradigms of virtual education (it is not a matter of implementing face-to-face dynamics through digital platforms). One of the many situations exacerbated by the pandemic was the lack of appropriate infrastructure, since "remote students and students with disabilities tend to be more disconnected than the rest of the student body" (Mas, 2020, paras. 9-10). Such disparity has resulted in online education not reaching all students. However, even the most modern of equipment and the healthiest of connections can break down at any time and ruin a class.

2.1 Methodology
Faced with this novel topic, the researcher undertook the task of reviewing the scarce literature available. She detected frequent coincidences among the articles examined, as raw material for a perception questionnaire, regarding the series of advantages and obstacles of virtual education. To write this paper, the most repeated ones were contextualized within the framework of the covid-19 pandemic. The research was developed with a descriptive methodology since it delineates the population, situation or phenomenon around which it is centered. It contains both quantitative and qualitative aspects. Regarding the quantitative aspect, the percentages obtained from several of the questions are analyzed through comparison and contrast (e.g. the level of preparedness of teachers to face virtual education in March 2020 versus the same line in September 2020). The qualitative aspect lies in obtaining both data from the participants and the information gathered through the open-ended questions. The study was carried out with the purpose of orienting the university community on the advantages and difficulties of virtual education in general and for students with functional diversity in these times of covid-19 pandemic.

2.3 The questionnaire
To ascertain the validity of the advantages and disadvantages of virtual education during the pandemic and its impact on the inclusion of students with functional diversity, the researcher drafted a questionnaire - on Google Forms - with 17 questions. Of the 17 questions, 12 were multiple choice and the remaining five were open-ended. Five of these asked students to provide information about their year of study, time spent in virtual education, the source of their Internet service for online courses (without probing the reliability of their connection), whether they had any type of impairment and whether they were given any reasonable accommodation. The rest was aimed at ascertaining the following: the level of preparedness - in March 2020 and at present - of various components of virtual education (teachers, students and educational institutions); the experience of students identified with impairments with online versus face-to-face courses; students' perceptions of what they consider to be the greatest advantages and challenges of virtual education; their views on how e-learning impacts the inclusion of students with functional diversity and the rationale for their response and their preferred mode of delivery.

The instrument, entitled Questionnaire on the advantages and difficulties of virtual education during the covid-19 pandemic, was administered freely and voluntarily to 133 students from three different courses at the School of General Studies of the Río Piedras Campus of the University of Puerto Rico. There were four sections of Espa 3101 (Basic Spanish I), one of Espa 3102 (Basic Spanish II) and one of Espa 3036 (Ficción e historia en la novela hispanoamericana de fines de siglo XX).

3. Results

Throughout the second week of September 2021, participants completed the questionnaire. 69.2% of the students are in their first (34.6%) or second year (34.6%) of study. More than half of the students (51.1%) have been taking online courses for a period of one and a half years versus 39.8% who have been taking online courses for over two years.

Concerning the level of preparedness of teachers, students and educational institutions for the sudden shift to virtual education forced by the covid-19 pandemic in March 2020, 81.2% felt that they were not adequately prepared versus 18.8% who disagreed. A year and a half later, 55.6% of mentees felt that these components were adequately prepared for virtual education compared to 44.4% who said the opposite. A year and a half into the pandemic, the perception has improved by 25.6%. An overwhelming majority of respondents - 95.5% - indicated that the Internet service they use for their courses belongs to their residence, which may or may not be located in the same city as the university. Others use the Internet at the university, at a store/shopping center, at a friend's house, at work, or other.

When asked about the greatest advantage of online courses, 36.8% gave preeminence to flexibility. In second place, 31.6% favored the possibility of taking the class from any location. Third, 17.3% agreed that virtual education saves time and money. Fourth, 12.8% recognized the benefit of round-the-clock access to course materials. Fifth, only 1.5% welcomed the use of information and communication technologies (ICT) as beneficial. The next question in the questionnaire explored the flip side of the coin: the pitfalls of this type of education. Among the major difficulties of virtual education, 54.1% encountered many distractions; 37.6% said that interaction with the teacher and classmates was very limited; and the remaining 8.3% - in descending order - faced problems with both discipline and planning, did not have adequate technological infrastructure or lacked technological skills.

Fifteen students (11.3%) revealed that they had some impediment and 9.8% (13 students) were provided with one or more reasonable accommodations. Six of these (40%) judged their experience with virtual courses to be worse as opposed to face-to-face courses versus 13.3% who stated the opposite. Three students (20%) found no difference between the two

practices and the remaining 26.7% were unsure. While several students with attention deficit hyperactivity disorder (ADHD) and specific learning disabilities (SLD) denounced the lack of concentration and difficulty in understanding concepts in contrast to the face-to-face context, another - with diabetes (type 1) - defended it. He said: "Being virtual has been a great help because I am at home and I can eat at the right times and have a more balanced diet to control my glucose". Many students responded to the open-ended question about the greatest advantage of virtual education by appealing to almost all of the alternatives in the multiple choice above (e.g. saving time and money; flexibility; taking classes from anywhere; and continuous access to course materials). Some have been able to start their business and work more. There was one case who testified that he benefits from "...the limited social interaction as I suffer from social anxiety. Even, not having to transport myself allows me to sleep more and have more energy." Other young people emphasized that virtual education is a necessary evil for those who want to study without taking risks and "stop the chain of contagion". This quote from one of the respondents shares this sentiment:

> I understand that given the situation we are facing, virtual education has allowed students to continue acquiring knowledge. In other words, the teaching process is not paralyzed. Also, virtual education allows students to do their educational work from their homes so they can save money on transportation. The most important thing is that each student continues to learn and does not fall behind academically.

In referring to the most significant challenges of virtual education in the open-ended question, many of the students resorted to the options in the question about the difficulties of virtual education (e.g., inadequate technological infrastructure, lack of technological skills, distractions, planning-discipline, limited interaction between students and the teacher). They mentioned others such as "drastic change", "self-teaching", competing for study spaces with their siblings with online classes, noise, constant blackouts, poor Internet connection and "distinguishing the educational environment from the familiar one under the same roof". After inquiring about these items, students were asked their opinion on whether virtual education promoted or hindered the inclusion of students with functional diversity in the classroom. In addition, they were asked for their reason for this. A total of 72.9% (97 students) claimed that it sometimes favors and sometimes hinders inclusion of these students. The following is a quote that exemplifies this opinion:

> I think it depends on what type of functional diversity the student has. For example, if it is a matter of a person who needs a wheelchair, the online modality favors him/her because he/she does not have to move or worry about whether there are ramps. However, there are students with functional diversity who need to be face-to-face in order to learn. It all depends on the individual.

10.5% (14 students) considered that virtual education is detrimental to inclusion versus 6.8% (nine students) that it promotes it. Detractors insisted on distractions, technical problems, boredom and the difficulty of virtual education regardless of whether or not they have a handicap. Proponents emphasized the freedom that virtual education offers, the extra time for homework and "how it helps shy people communicate more easily. Thirteen students - 9.8% - agreed that virtual education does not impact inclusion in any direction.

The last question of the questionnaire revolved around teaching modality preferences: face-to-face, virtual, hybrid or indifferent. Fifty-seven students (42.9%) favored face-to-face versus fifty-two (39.1%) hybrid education. Sixteen university students (12%) showed a predilection for virtual education and the rest (eight students for 8%) were indifferent. After so many months of confinement, students have been able to compare to the point of assuring "that they learn more in face-to-face courses", "they are more accustomed to them", "that virtual education will not be able to replace the benefits provided by face-to-face education and that "there are experiences that require one to be face-to-face to take advantage of them". Of course, others would not hesitate to stay online because "it fits my schedule perfectly" and "I find it more convenient" and because of "security concerns about COVID-19". A good number of them want to combine the best of both worlds - face-to-face and online - to enjoy the face-to-face interaction of the university experience without sacrificing flexibility, even if conditions are not yet ideal.

4. Discusión

4.1 Recomendations
Both multiple studies and learner experiences have shown that virtual education is not a panacea for educational institutions nor is it for everyone regardless of their functional diversity. Scott (2021) provides as an example Coursera's change of modality for most

corporate training degree courses and professional certificates (para. 15). Scott (2021) confirms that "the experience of companies offering MOOCs (Massive Open Online Courses) is also sobering" (para. 15). Online courses require the discipline and attention of students. Hence, according to Scott (2021), "a large number of those who enrolled did not complete them" (para. 15). Scott (2021) notes that "when the pandemic required universities to resort to remote teaching and learning, online instruction proved that it could work well when faculty are prepared and both institutions and students are equipped for it" (para. 14). Those instances were the exceptions rather than the rules. The expert insists that

> faculty needed to be trained, unless they had experience in distance learning; equipment needed to be upgraded and course design and graphics improved, unless the campus already had a strong online presence; and students needed to have the equipment, Internet and broadband access, and a quiet place to study in a non-campus location (Scott, 2021. para. 14).

Closing digital divides and adopting the principles of universal design in virtual education can more effectively promote the inclusion of students with functional diversity in these pandemic times. Herrera Nieves and Montes Soldado (2018) ratify that.

> designing virtual learning environments for all involves both minimizing barriers and recognizing different populations, intelligence types and learning styles. In this context, the principles that frame universal design in learning (UDL, called universal design in instruction in the university setting) are: providing multiple ways of representing information and content; providing multiple ways of action and expression of learning; and providing multiple ways of engagement (p. 3).

Some additional recommendations to promote the inclusion of all in virtual education are: simple course navigation, opportunity for interaction (through the chosen platform, e-mail and even telephone, among other means), psychological accessibility, linking students to class material (relevance), availability of materials in different formats (text, graphic, audio and video, among others), balanced use of assistive technologies, providing clear instructions, supplying work rubrics in advance and a - fair and varied - number of evaluations. A curious fact is that, although the SAD does not contemplate the use of technology, "it exhibits relevant features such as versatility, the capacity for transformation, the power to mark and organize, and the potential to generate learning networks" (Rose and Meyer, 2002, p. 64), so fundamental to achieve education for all.

5. Conclusion

These almost two years of covid-19 have brought with them powerful lessons for governments, businesses and the field of education, among others. It was necessary to act quickly and adapt to a new and uncertain scenario. With its obstacles and the need for adjustments for all those involved in the process, the alternative provided by technology through virtual education is emerging, in this world so transmuted by a pandemic, as the most feasible choice for every student -with or without handicap- who wishes to study, survive and feel included. This modality undoubtedly has its merit since it came to the rescue of many educational institutions in times of crisis. Apart from keeping the university community protected, university centers were able to return to their teaching and administrative functions.

From the successes and mistakes of the past months, administrators, professors and students must learn and internalize the urgency of making modifications so that - to the extent possible - virtual education is free of challenges and more effective. First,

administrators must constantly review and amend university policies and regulations regarding online courses. Second, institutions must continually provide training on the use of educational platforms and ICT for the entire university community. Third, institutions should identify, through questionnaires and interviews, the levels of access of individuals - faculty, students and employees - to infrastructure (e.g. computers and Internet access, among others) in order to provide alternatives to those most disadvantaged by distance or socioeconomic status. Fourth, teachers and students should be individually imbued with the management of educational platforms and ICTs. Many students may be very proficient when it comes to social networks (something that looks like fun for them), however, they show great gaps when dealing with an educational platform (something that is a must in this day and age). Fifth, if a teacher or a disciple stays at home to study or to work, he/she should have a conducive environment for the teaching-learning process (quiet, comfortable and uninterrupted) and enlist the cooperation of his/her family for it. Sixth, teachers must be trained in the principles of the SAD in order to embrace the functional diversity of their students in a virtual classroom and make everyone feel included.

Despite the urgency of returning to the university, the desire to socialize with the rest of the components of a campus and the preference for face-to-face education - out of habit or conviction - of many, the coronavirus has not been eradicated and continues to be our daily bread. Although the pandemic's expiration date is looming closer, it has not been specified. A long-awaited end depends on a myriad of factors such as inoculation rates to achieve herd immunity, the ease of obtaining covid-19 tests, the existence of effective outpatient treatments for sufferers, and the responsibility of citizens to curb contagion. Therefore, virtual education-asynchronous or synchronous-should not be demonized or dismissed at this time. After all, it has allowed thousands to be educated within the framework of a new normality, something simply difficult to conceive of in times past.

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