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Challenges of E-Learning in the Continuing Education Process in the Ecuadorian Amazon

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As part of a country's development, the training of human talent allows for the generation of competitiveness and development in the business and economic spheres. Only nations that have constant training propose mechanisms to solve the current problems in a creative, technical and innovative way. The present study focuses on knowing the challenges that are present in Continuing Education in the Ecuadorian Amazon, how technological resources contribute to this process and the current situation of the application of E-learning in education processes in different public and private companies. A descriptive research is applied, based on several surveys aimed at professionals and the community in general in eastern Ecuador. A review of databases related to virtual training is carried out to determine the status of Continuous Training in the Amazon area in Ecuador; as well as the challenges that E-learning presents, inviting them to achieve decent education standards that allow them to develop their professional activities in a better way according to the demands of the current environment.

Keywords: E-learning, Continuing Education, virtual education.

1. Introduction

One of the main concerns of a country's public and private institutions is to ensure that their personnel carry out the activities entrusted to them in the shortest possible time and with reliable results. To do this, constant training is needed based on the operational needs, technical areas and social behavior of the company, according to the standards demanded by today's growing society.

Technical specialization contributes to the development of societies, creating competitive,

innovative spaces, with an additional plus to the services and products offered. As a result, the population is looking for learning opportunities, adapting to the changing needs of the local population. In a context marked by cultural diversity and socioeconomic challenges, continuing education is presented as a key tool to improve work skills, promote community development and preserve cultural traditions. [1]

But to achieve all this, they have to try to overcome, the problems that arise for the execution of the training of human resources are: geography and road conditions[1], inadequate infrastructure [2], lack of qualified teachers, training and support [3], cultural and linguistic diversity, bilingual intercultural education [4], poverty, health and nutrition, access to technology, educational innovation [5], insufficient investment, inadequate policies.

Based on the information obtained from the Ministry of Labor, it is evident that 21 universities in the country offer virtual or online continuous training until 2023[6]. In the Amazon area comprised of its provinces of Sucumbíos, Orellana, Pastaza, Napo, Morona Santiago and Zamora Chinchipe.

The State has created laws that allow it to contribute to the Amazon area, considered as a social group that requires greater support through inclusion in all processes, and even more so the digital one, which due to its characteristics has limited its technological development, marking marked differences in an accentuated way. Thus, axis 2 of the Digital Transformation Agenda[7] "Culture and Digital Inclusion" incorporates a pillar aimed at virtual education, as well as pillar 3 of "Digital Economy" seeks to evolve the productive sectors with the support of digital media and the Internet. Therefore, E-learning supports this approach.

2. Methodology

The research is descriptive, exploratory, the latter being a research approach that is used to determine problems on which there are few previous studies or to discover patterns and generate new hypotheses. This type of methodology is flexible and open, allowing the researcher to adapt their approach as new findings develop. Its main objective is to obtain an initial and broad understanding of the phenomenon under study, rather than to test specific hypotheses [8], to gain a detailed and preliminary understanding of a specific phenomenon or situation. This methodology is particularly useful in contexts where there is little prior information or where it is sought to identify emerging characteristics and patterns before formulating more specific hypotheses and carrying out more detailed studies. The analysis was initially carried out by identifying patterns, relationships and areas that require through statistics obtained from SECTEC sources and the academic offer of the CES. and SECAP in relation to continuing education. Additionally, case studies were carried out directed through surveys and statistical analysis to professionals in the city of Macas, where the research is focused for the application of E-learning as a tool for improving continuing education, to capture the results descriptive analysis was used to summarize and describe the data collected to finally present the results both narratively, highlighting the main themes and perceptions of the participants, as well as statistically, providing quantitative data to support the descriptive observations.

Research Questions

The study aims to answer the following research questions:

Q1: What are the main problems and challenges of E-learning in the Amazon area of Ecuador?

Justification: This question seeks to identify entities that are dedicated to continuous training, areas of training courses both in specialization and postgraduate courses, as well as to identify the technical, social and economic problems and challenges present in the Amazon, giving the opportunity for new studies.

Q2: What teaching methodology can be applicable in the Amazon area that adapts to virtual training?

Q3: What are the best practices adaptable to virtual training in the Amazon area?

To answer these questions, 3 moments for research are proposed:

1. Establish the current situation of Continuing Education through digital information mechanisms related to the Amazon area: An exhaustive review of information sources is carried out to identify the state of continuing education in the provinces of the Amazon, thus identifying the different problems and challenges existing in the area as well as the areas of training of interest through the required training needs.

2. Determine the methodology to be applied to online training through the study of the characteristics of the area: After identifying the training needs and with an adequate theoretical basis, the most appropriate combination of methodologies is sought for the development of the training that will serve for the study.

3. Determine a set of best practices for training through the use of E-learning as a tool for improvement in continuing education: By using e-learning as a tool for the improvement of continuing education, the best practices that can be applied for the training and improvement of professional skills are determined.

3. Education Continuous in the Ecuadorian Amazon

The institutions that are in charge of creating training have incorporated technology as one of their tools to improve the quality of the teaching-learning process, leaving aside traditional methods; Even more so after the pandemic period, education has evolved radically [9]. The evolution from traditional to virtual education has been a significant process, driven by technological advancement and the changing needs of society. Employability was transformed by adapting to the virtual modality, where ICTs became present in people's daily lives, with technological training on the part of the employer and the employee being a priority.

Employers must train their employees to improve productivity, foster innovation, and maintain a competitive advantage in the marketplace. Continuous training allows employees to acquire new skills and knowledge that are essential in an ever-changing work environment, increasing the efficiency and quality of work done. In addition, investing in professional development can increase staff satisfaction and retention, reducing costs associated with employee turnover. "Employee training and development not only improves technical skills, but also promotes a

positive and engaged work environment, which is crucial for organizational success." [10]

In eastern Ecuador, virtual education presented itself unexpectedly. There was minimal experience of virtual or online education through universities that offered careers in virtual or semi-face-to-face mode, whose main causes are: minimal interest in the development of digital skills by professionals and non-professionals in the different areas, high costs of online training courses for the workplace, access to the internet, low purchasing power of devices for the implementation of virtual education, among others.

Table 1. the number of continuing education courses reported by SECTEC until 2023 in the six eastern provinces in its different modalities is detailed, determining that only 20.32% are virtual and 79.67% are face-to-face.

Table 1. Modalities of continuous training in Ecuador-Source: SECTEC

PROVINCE	FACE	SEMI-FACE-TO-FACE	VIRTUAL	Total, overall
MORONA SANTIAGO	8			8
NAPO	4			4
ORELLANA	70		4	74
PASTAZA	98	13	59	170
SUCUMBIOS	41			41
ZAMORA CHINCHIPE	13			13
Grand total	234	13	63	310

Figure 1. It can be determined that the modality with the highest execution of training is face-to-face, where the province with the highest rate of training is Pastaza.

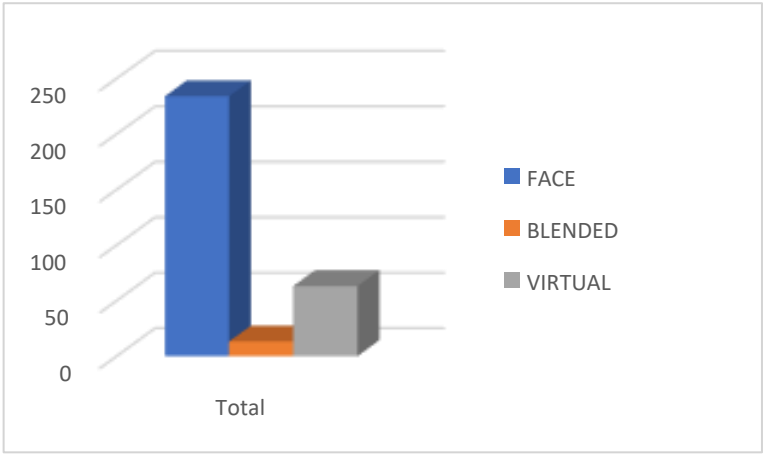

Figure 1.Virtual Education Modalities Ecuador to 2023

b. Continuing Education Areas

The province of Pastaza has the largest part of continuing education courses, with 59 training offers, followed by Orellana, where the areas of interest are aligned with: crafts, industrial processes (21.29%), education (14.51%), forestry and environment (14.51%) and

administration (13.22%), ICTs (13.54%); Many of these courses are issued by higher education institutes and others are private companies. It is important to indicate that these data are extracted from entities that have the corresponding certification and are recognized by the Ministry of Labor[6].

The virtual modality is focused on Information and Communication Technologies, forestry, ecology and environment; as well as education, the rest of the areas continue to be carried out in person, which means that staff must go to those cities, wasting time and resources.

Table 2. Continuing education in Ecuador in the Amazon area by areas of interest (2023)- Source: SECTEC

AREA	FACE	BLENDED	VIRTUAL	Grand total
ADMINISTRATION AND LEGISLATION	25	8	8	41
FOOD, GASTRONOMY AND TOURISM	15	2	1	18
ARTS AND CRAFTS	7		1	8
COMMUNICATION AND GRAPHIC ARTS	3		2	5
CONSTRUCTION AND INFRASTRUCTURE	3		1	4
EDUCATION AND TRAINING	35		10	45
ELECTRICITY AND ELECTRONICS	16			16
FINANCE, TRADE AND SALES	5		2	7
FORESTRY, ECOLOGY AND ENVIRONMENT	22	3	20	45
AUTOMOTIVE MECHANICS	1			1
INDUSTRIAL MECHANICS AND MINING	5			5
INDUSTRIAL PROCESSES	61		5	66
SOCIOCULTURAL AND SOCIAL SERVICES COMMUNITY	5			5
INFORMATION AND COMMUNICATION TECHNOLOGIES	29		13	42
TRANSPORT AND LOGISTICS	2			2
Grand total	234	13	63	310

c. Continuing education according to the CES

Through the Council of Higher Education (CES), which is the planning, regulatory and coordinating body of the National System of Higher Education of the Republic of Ecuador, it is concluded that to date a total of 2287 programs or careers are offered [11], of which 597 (26%) are online. As can be seen in Figure 2 Programs or Careers by Type of training, 99% of the Programs or Careers correspond to Professional Master's Degrees, where the academic

areas that offer the most Programs or Careers are: Administration (31%), Social Sciences, Journalism, Information and Law (22%) and Education (20%). It can be seen that in the academic areas that offer the most Programs or Careers are: Administration (31%), Social Sciences, Journalism, Information and Law (22%) and Education (20%). Additionally, a total absence of online academic offerings is identified in the Amazonian provinces: Sucumbíos, Orellana, Morona Santiago and Zamora Chinchipe, it can be seen that in the academic areas that offer the most Programs or Careers are: Administration (31%), Social Sciences, Journalism, Information and Law (22%) and Education (20%). Additionally, a total absence of online academic offerings is identified in the Amazonian provinces: Sucumbíos, Orellana, Morona Santiago and Zamora Chinchipe.

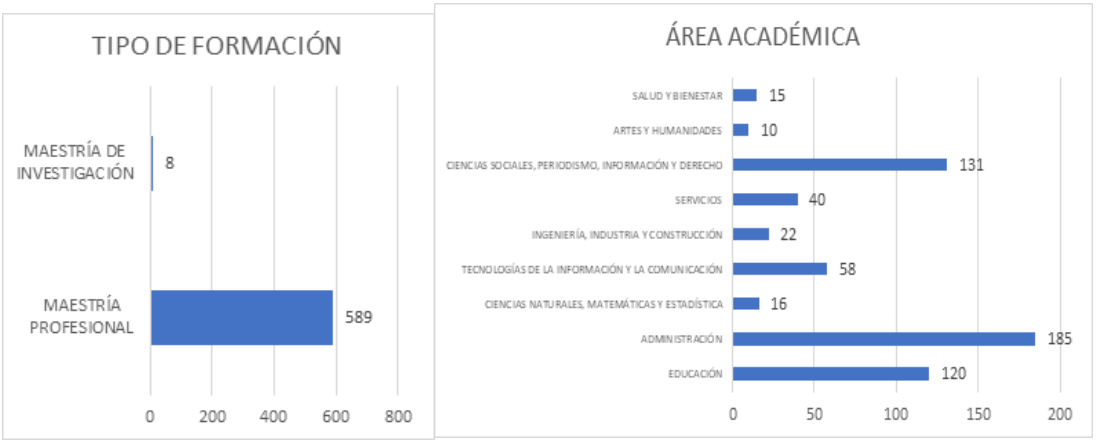

Figure 2. Postgraduate academic offer in Ecuador Source: CES. In original language Spanish

d. Continuing education in accordance with SECAP

The Ecuadorian Professional Training Service (SECAP), is an institution attached to the Ministry of Labor in Ecuador, which offers to date a total of 41 courses or programs where 95% are of short duration[12].

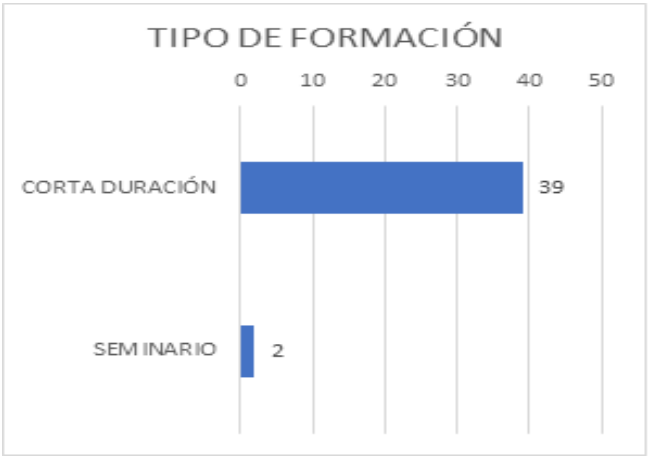

Figure 3. SECAP Courses by Training Type. In original language Spanish

From this data, it is analyzed that the seminars should increase their content to provide an attractive offer with the duration of the seminar. The academic areas with the most Courses or Programs are: Administration and Legislation (29%), Industrial Processes (17%) and Information and Communication Technologies (17%). the largest number of Courses or Programs are offered in: Guayas (27%), Napo (15%) and Carchi (15%), evidencing a total absence of online or virtual academic offerings in the Amazonian provinces: Sucumbíos, Orellana, Morona Santiago and Zamora Chinchipe.

4. Methodology for E-Learning in the Amazon Area.

Higher education institutions have implemented their educational platforms and in turn their Virtual Learning Environments (VLEs). As part of the deployment of the EVAs, virtual courses must be created. However, due to the factors of demands for changes to a virtual modality, as a result of the pandemic caused by COVID-19, virtual classrooms have been migrated expressly, that is, in a hurry and without methodological support, This produces a bad practice in the design of virtual courses. It has been noticed that the designs of virtual courses are created in a very similar way in the teachers, so the courses are usually repeated over time, because they are based on a possibly copied design, which causes that the other teachers tend to reuse a prototype with slight modifications[13]

There are also reasons that are probably due to the lack of training in the pedagogical aspect of creating virtual classrooms, that is, preparation in the area of instructional design oriented to teachers[14]. Although each teacher tries to create their virtual classroom design at their convenience, they continue to rely on some simplistic example acquired in their teacher training. In addition to all this, there is the fact that in order to design virtual courses, pedagogical aspects must be taken into account, which improve the quality of E-learning environments and therefore the quality of virtual courses.

4.1 Instructional Design Models

Instructional design models are based on and planned learning theories, with some instructional design models emerging such as:

• Gagné's model. The author systematizes an integrative approach where aspects of stimulus-response theories and information processing models are considered. Gagné believes that at least ten functions must be fulfilled in teaching for true learning to take place. [15]

• Gagné and Briggs model. It is basically used for the instructional design of curricular plans at the level of educational systems [16]

• ASSURE model by Heinich et al.. It has its theoretical roots in behaviorism, based on Gagné's (1985) approach, identifying constructivist traits by being concerned with student participation and engagement. [17]

• Dick and Carey's model. It is a behaviorist and reductionist model, which focuses on the skills and knowledge that are taught and provide the conditions for learning.[18]

• Jonassen's model. It is a constructivist model, which emphasizes the role of the learner in the construction of knowledge. [19]

These models are very general and according to the analysis carried out they do not specifically describe how to design a virtual classroom. For this reason, a bibliographic review of methodological proposals is carried out to design virtual environments that comply with greater characteristics and details, resulting (Table 3):

Table 3. Instructional design models resulting from research

No.	Metodología	Autor	Año	Referencia
1	SOAR course conversion process	Steven D'Agustino	2012	(D'Agustino, 2012)
2	Modelo Pedagógico Mediacional de Educación a Distancia	Jaramillo-Morales, C. O., Conde-Pinzón, G. E., & Londoño-Villamil, G.	2020	(Jaramillo Morales et al., 2020)
3	Modelo refinado según Gagné y Briggs basado en el enfoque de sistemas	Alexandra Abuchar, Fredys Simanca	2009	(Pagano & Buitron, 2009)
4	La metodología para el diseño de actividades	E.T. Aguirre, S.L. Gómez, R. Y. Gómez, N. Villegas	2019	(Mejía et al., 2019)
5	Metodología propuesta para diseñar un proyecto de curso virtual	Renata Marciniak	2017	(Marciniak, 2017)
6	Metodología PACIE	Pedro Camacho	2009	(Leoni Handel, 2010)
7	Un modelo para el diseño de cursos virtuales de aprendizaje por competencias	Juan Puello, Ramiro barragan	2008	(Bohorquez & Beltran, 2008)

4.2 PACIE Methodology

After carrying out an analysis based on the characteristics of the Amazon area and the flexibility it provides, the PACIE methodology is chosen for the design of the virtual classrooms. The PACIE methodology (Presence, Reach, Training, Interaction, E-learning) is an educational methodology developed with the purpose of incorporating technology into the educational process, to enhance self-learning and the experience of building knowledge collectively, its advantage is the adaptability to face-to-face, semi-virtual or online courses[20]. Figure 4 describes each of the components of the methodology.

Figure 4. Components of the PACIE Methodology. In original language Spanish

• Presence Phase. It is one of the most important phases, since its objective is to motivate users by providing them with an environment of relevance by creating sensations of a simple design with graphic elements by default.

• Scope Phase. It indicates that the objectives to be achieved must be clear, such as the educational objective to be achieved and the objectives that respond to the planning of the scope and practicality of the virtual classroom.

• Training Phase. It refers to the preparation that the tutor must have to start with the operation of the virtual classroom, to be trained and confident in the walk of the virtual classroom and ready to be able to provide support to the participants when they require it.

• Interaction phase. It responds to actions aimed at creating an environment of stimulation and socialization by students with the tutor and vice versa.

• E-Learning Phase. It is aimed at the success generated by the inclusion of the resources and tools that are included in the educational process. To generate and awaken skills and abilities in the participants for the implementation of the knowledge that these 8 interactive, motivating and guiding resources have given rise to, supported by technology and pedagogy[20].

4.3 Virtual Classroom Structure

4.3.1 Aspects to consider for the design of the virtual classroom

• Quality of connectivity in the area. According to a study by the company Mentinno, as of 2022 the province of Morona Santiago is not considered among the provinces with the highest use of the internet, perhaps due to the limitations that the Amazon has for Internet service[16]. The use of this service in the area is 31.47%, where the provinces with the worst coverage are Morona Santiago (27.1%) and Orellana (22.2%).

- Role of the teacher. The teacher becomes a tutor, since his or her role is to provide support during the learning process, as well as to provide affective support and guidance in administrative aspects[21]

- Media. Knowing that internet service in the area is limited and that its quality is not the best due to geographical conditions, it is important to design elements that do not require high levels of bandwidth consumption to be loaded.

- Integration of social networks into the process. Social networks can become an additional element that allows the process of communication and feedback in a planned way between the teacher and the participants in the virtual training process.

4.3.2 Basic elements for the design of the virtual classroom

Based on the experience of the Polytechnic School of Chimborazo, the use of the following elements has been considered:

- Course overview items. These elements are related to the course planning, number of tasks, evaluation criteria, tutor profile (informative data, professional training).

- Topic content elements. The content of the different topics to be addressed in the course may be designed as pdf documents, presentations in pdf format, urls of videos that complement the explanation of the topic, among others.

- Elements of communication and social feedback. Communication between participants can be designed with forums and chat, as well as real-time class sessions that will be recorded for those participants who did not attend.

- Elements of evaluation. They will contain those activities that will allow the knowledge acquired to be evaluated in a systematic and evolutionary way, which can be tasks, questionnaires, essays, among others.

- Elements of state. Those resources that allow the participant to visualize their percentage of progress in the course.

- Elements of tutoring and reinforcement of the training process. These elements are intended to solve doubts, academic and general needs.

4.3.3 Virtual classroom structure

Within the study, a modular structure was designed for the virtual classroom, considering the following blocks:

Figure 5. Virtual classroom structure based on the PACIE methodology. In original language Spanish

• Block 0. Block 0 is the initial section where information about the course, the tutor and evaluation aspects are implemented. It should also explain the communication system by guiding the student on work schedules, questions and answers about the course and an initial interaction space where students and the tutor interact at first.

• The academic block. The academic block is the section of the classroom that is distributed in several modules depending on the number of topics or weeks of class. The tutor will be the one who determines the disposition of the same, trying to facilitate the access of the resources by the student. This must contain the information and content on the topic or learning session, another rebound section in which activities are scheduled where the information presented is questioned, analyzed, filtered or interrogated; followed by a section on knowledge construction, where activities are worked on in which students answer questions, perform a task, work on a project, build or expose their learning on a research or activity carried out, can criticize and analyze the results of their work or, depending on the topic, discuss their position on the information presented; Finally, there must be a synthesis, verification or verification block where the student can demonstrate and/or summarize what they have learned through comments, tasks and questionnaires.

• Closure block. This block goes at the end and is characterized by allowing the completion of pending tasks or closing unfinished processes of the course or tutorial work. It includes two sections, the first negotiation section, in which, depending on the needs, communication with the teacher can be promoted to deliver work and can have a farewell forum in which all participants can interact.

5. Results and Discussion

a. Current situation of virtual education in the Ecuadorian Amazon.

After reviewing the databases of SETEI, CES and SECAP, it is identified that the presence of continuing education in virtual mode is limited in most provinces of Eastern Ecuador. The province with the greatest development of formation is Pastaza, followed by Orellana and Napo, while the central-southeastern provinces have little prominence.

The following is an overview of certain factors that influence the adoption of virtual education:

• Limited Internet Access: Internet connectivity in rural and remote areas of the Ecuadorian Amazon has traditionally been low[22]. Factors such as geographical dispersion, difficult topography, and lack of adequate infrastructure have limited access to reliable and affordable internet services.

• Technological Infrastructure: The infrastructure to support broadband and mobile technologies in the region has been under development, with efforts by both government and non-governmental organizations to expand coverage. However, the investments still do not cover all the areas in need.

• Expansion of Mobile Coverage: There is significant growth in mobile phone coverage, with increasing penetration of smartphone use. This is due, in part, to government programs and the interest of telecommunications companies in expanding their services.

- Initiatives to Improve Connectivity: There are projects aimed at improving connectivity in the Amazon, including the deployment of more mobile phone base stations and the use of technologies such as satellites and fiber optic networks to reach remote communities. Infocentres are also available[6] in each city that must be reopened for use.

- Education and ICTs: The use of technological means in education has been promoted by various initiatives that seek to integrate ICTs into the educational process, although implementation is uneven and faces the challenge of teacher training and curricular adaptation.

- Distance Education: Distance education programs have been implemented to overcome geographical barriers, leveraging online platforms and digital content. However, the success of these programs depends largely on improving connectivity.

- Training and Resources: There are efforts to train educators in the use of ICTs and to provide schools with basic technological resources, although the need exceeds the resources currently available.

b. Socio-economic influence of E-learning in the Amazon

Based on a university academic project, the following indicators related to the socio-economic field are determined in a sample of 312 surveys with citizens between 19 and 25 years old, with 59.5% women and 38.9% men from the city of Macas.

- Knowledge of e-learning 87.3%
- Importance of e-learning for society: 93.7%
- Participation in virtual courses: 87.23%
- Effective learning: 72.2% face-to-face and 27.8% virtual
- Positive influence of e-learning in emergency situations: 96%
- Connection from home: 93.7%
- Availability of a proprietary digital device: 30.5%
- Borrowed device usage: 69.5%
- Increase in connectivity expenses: 54.8%
- Digital resource management ability: 96%
- Level of use of digital devices: 94.4%
- Benefit when including in expenses guaranteeing quality of internet access: 88.9%

c. Challenges of E-learning in the Amazon

The implementation of virtual education in the Ecuadorian Amazon faces several unique challenges, influenced by the cultural, geographical, and socioeconomic diversity of the region. These challenges can be examined from multiple perspectives, including technological infrastructure, access to resources, teacher training, curricular adaptation, and community engagement.

- Technological Infrastructure and Connectivity

Limited internet access is one of the most significant challenges for virtual education in the Amazon[22]. The difficult topography and dispersion of communities make it difficult to install and maintain the infrastructure needed to ensure a stable, high-speed connection. In addition, the dependence on electrical power, which in many areas is unstable or non-existent, limits the use of electronic devices necessary for online learning.

- Access to Resources

The lack of adequate and accessible technological devices, such as computers, tablets or smartphones, is another obstacle. Even in areas with some degree of connectivity, the cost and availability of these devices can be prohibitive for many families, limiting students' access to online learning platforms.

- Teacher Training

Preparing educators for teaching in virtual environments is critical. However, in the Ecuadorian Amazon, many teachers lack the necessary training in digital tools and online teaching methodologies. This deficit in teacher training affects the quality and effectiveness of the virtual teaching-learning process[23].

- Curricular Adaptation

Creating digital content that is culturally relevant and appropriate for the specific needs and contexts of Amazonian communities represents an additional challenge. It is crucial to adapt curricula to reflect the cultural, linguistic and environmental richness of the region, thus promoting inclusive and relevant education.

- Community Engagement

Virtual education requires not only technological infrastructures and capacities, but also the active participation of communities. Fostering this participation can be challenging due to the diversity of languages and cultures, as well as mistrust or misunderstanding of the benefits of online education[24]. It is vital to involve communities in the design and implementation of virtual educational programs to ensure their relevance and acceptance.

- Ethical and Environmental Considerations

The implementation of information technologies in the Amazon must be carried out with sensitivity towards the preservation of the environment and respect for local cultures. E-learning projects should be designed in a way that supports environmental and cultural sustainability, avoiding the imposition of educational models that do not match the values and needs of local communities.

- Innovative and Collaborative Solutions

In the face of these challenges, it is crucial to seek innovative and collaborative solutions that involve multiple actors, including governments, non-governmental organizations, local communities, and the private sector. The creation of alliances to improve technological infrastructure, teacher training, the development of culturally adapted content and the promotion of inclusive and sustainable educational models are fundamental steps towards

overcoming the obstacles faced by virtual education in the Ecuadorian Amazon.

d. Didactic strategies of E-learning in the Ecuadorian Amazon.

The successful implementation of e-learning in the Ecuadorian Amazon can be given by the following strategies:

- Mobile Learning (m-learning)

Given the growing access to mobile devices even in remote areas, mobile learning is presented as a viable solution. This strategy involves designing educational materials specifically to be consumed on smartphones and tablets, leveraging applications and platforms that require low bandwidth or can work offline.

- Use of Offline Technologies

Implementing solutions that allow students to download study material when they have access to the internet for later offline use can be especially useful in areas with limited or unstable connectivity. This includes the use of USB devices, hard drives with pre-loaded content, and learning platforms that offer offline functionalities.

- Educational Radio and Television

Leverage traditional media, such as radio and television, to broadcast educational content. These media can reach communities where digital technology is scarce, offering educational programs, lessons, and spaces for interaction through calls or messages.

- Teacher Training & Support

Provide ongoing training to educators in the use of digital technologies and online teaching strategies. This includes the development of digital skills, instructional design for e-learning, and techniques to motivate and manage groups of students remotely.

- Culturally Relevant Educational Content

Develop and adapt teaching materials that are culturally relevant and linguistically appropriate for the diverse communities of the Amazon. This involves collaborating with leaders and community members to create content that reflects their knowledge, languages, and socio-cultural contexts.

- Project-Based Learning

Promote project-based learning that allows students to apply knowledge to real situations in their environment. This encourages meaningful learning, critical skill development, and problem-solving relevant to their communities.

- Flexibility and Customization

Offer flexible learning options that allow students to progress at their own pace, adapting study times to their personal needs and responsibilities. This is crucial in communities where students may have to balance their studies with work or family responsibilities.

- Discussion Forums and Learning Networks

Create virtual spaces for interaction such as forums, chats, or educational social networks that

promote communication and collaboration between students and teachers. This helps overcome isolation and promotes a collaborative learning community.

Incorporating these strategies requires an integrated approach and the commitment of multiple actors, such as government, civil society, and educational communities. Through the creative adaptation of pedagogical technologies and methodologies, it is possible to overcome obstacles and harness the potential of e-learning to improve education in the Ecuadorian Amazon.

e. Best E-learning practices in the Ecuadorian Amazon.

To guarantee the effectiveness and sustainability of e-learning or virtual education in the Ecuadorian Amazon[25], it is critical to adopt a set of best practices that consider both the unique characteristics of this region and the needs of its communities. These practices must address the challenges of connectivity, cultural diversity, accessibility, and educational quality. Here are some of the best practices identified for the Ecuadorian Amazon context:

1. Inclusive and Accessible Design

Cultural Adaptability: Create content that respects and reflects the cultural, linguistic, and social diversity of Amazonian communities.

Accessibility: Ensure that materials and platforms are accessible to people with different needs, including those with connectivity limitations or disabilities.

2. Flexibility and Customization

Self-directed learning: Offer flexible learning paths that allow students to progress at their own pace.

Personalization of Learning: Implement tools and strategies that allow learning to be adapted to individual needs, interests, and skill levels.

3. Use of Appropriate Technologies

Offline Solutions: Incorporate technologies that allow access to content and activities without the need for a constant Internet connection.

Multimedia and Gamification: Use multimedia resources and gamification techniques to increase student engagement and motivation.

4. Training and Ongoing Support for Educators

Teacher Training: Offer continuous training in virtual teaching methodologies, technological tools and design of digital educational materials.

Technical and Pedagogical Support: Provide constant technical and pedagogical support to teachers to facilitate their adaptation to the virtual environment.

5. Evaluation and Feedback

Adaptive Assessments: Implement assessment systems that consider the context and individual abilities of students, providing constructive and timely feedback.

Progress Monitoring: Use analytical tools to monitor student progress and engagement,

allowing for early interventions when necessary.

6. Strengthening of the Educational Community

Collaborative Learning Networks: Encourage networking among students, educators, and communities to share resources, experiences, and support.

Community Participation: Involve local communities in the educational process, recognizing and valuing their traditional knowledge and practices.

7. Sustainability and Scalability

Strategic Alliances: Establish alliances with government entities, non-governmental organizations, the private sector and civil society to support the financing, implementation and scalability of projects.

Continuous Evaluation: Conduct periodic evaluations of e-learning programs to identify areas for improvement, ensure their relevance and effectiveness, and adjust strategies as needed.

6. Conclusions

- E-learning stands out as a powerful tool for the empowerment of communities in the eastern Amazon. By facilitating access to continuing education and the development of skills relevant to the labor market, e-learning has the potential to contribute significantly to the sustainable development of the region.

- By overcoming the physical and geographical barriers that have traditionally limited access to quality educational resources, this learning modality allows people living in remote and isolated areas to access continuing education programs, specialization courses, and vocational training that were previously out of reach. This expansion in access is crucial for the socioeconomic development of the region, as it promotes educational equity and opens new opportunities for the personal and professional growth of its inhabitants.

- Limited technological infrastructure, including spotty internet access and lack of adequate electronic devices, represents a significant barrier for many students. In addition, the need to strengthen the digital skills of teachers and students emerges as an essential prerequisite to maximize the potential of e-learning. These challenges require strategic attention and dedicated resources to ensure that e-learning can equitably benefit the entire population.

- The use of online learning platforms, digital tools, and multimedia educational resources not only facilitates the learning process, but also prepares individuals to participate effectively in an increasingly digitized economy. This aspect is particularly relevant in the eastern Amazon, where training in digital skills is essential to close the digital divide and foster broader social and economic inclusion.

- The contents of a virtual environment are reviewed by the participants of a virtual course, but as it is continuous education; it is the student who must take care of a discipline that allows learning to be obtained.

- There is a high degree of participants enrolled in a virtual course but the average

degree of participation is 42.07%, with a pass rate of 2.18% and the need for tutoring or accompaniment by the teacher is 80%.

References

1. INEC- INSTITUTE OF STATISTICS AND CENSUSES, "ECV Results Report 2013 - 2014". 2014.
2. V. Arévalo Vélez, «Threats to contemporary public school infrastructure in Ecuador in the face of calamities. Case: Millennium Educational Units", Rev. Scientific and Technological UPSE RCTU, vol. 7, n.or 2, pp. 64-73, Dec. 2020, doi: 10.26423/rctu.v7i2.539.
3. R. V. Jairo, V. A. David, and Z. L. Daniel, "EQUIPO TÉCNICO Arias", vol. 3, 2022.
4. «Anexo_09_Modelo_Educativo.pdf". Accessed: May 19, 2024. [Online]. Available in: https://uaw.edu.ec/wp-content/uploads/RendicionDeCuentas/2021/Anexo_09_Modelo_Educativo.pdf
5. "Project: "AMAZON MEETING POINTS"".
6. Ministry of Labour, "Continuing Education Centres". [Online]. Available in: https://www.trabajo.gob.ec/centros-de-educacion-continua/
7. Ministry of Telecommunications and Information Society, "Digital Transformation Agenda of Ecuador 2022-2025", Ecuador. [Online]. Available in: https://aportecivico.gobiernoelectronico.gob.ec/system/documents/attachments/000/000/098/original/ade31653435a0820a7b8b252953dabba6e3ec71b.pdf
8. «2. Hernández, Fernández and Baptista-Scientific Research Methodology 6th ed.pdf». Accessed: May 19, 2024. [Online]. Available in: https://www.esup.edu.pe/wp-content/uploads/2020/12/2.%20Hernandez,%20Fernandez%20y%20Baptista-Metodolog%C3%ADa%20Investigacion%20Cientifica%206ta%20ed.pdf
9. "CES - Academic Offer". Accessed: May 19, 2024. [Online]. Available in: https://appcmi.ces.gob.ec/oferta_vigente/
10. S. Watson, «Noe, R. (2017). Employee training and development . New York, NY: McGraw Hill Education. ISBN: 978-0078112850", Hum. Resour. Dev. Q., vol. 33, Nov. 2018, doi: 10.1002/hrdq.21333.
11. CES, "Academic Offer of the Council of Higher Education of Ecuador", Ecuador, 2024. [Online]. Available in: https://appcmi.ces.gob.ec/oferta_vigente/
12. Ecuadorian Professional Training Service, "Courses and Programs", Ecuador, 2024. Accessed: March 30, 2024. [Online]. Available in: https://si.secap.gob.ec/sisecap/ofertaCapacitacion/
13. D. Pástor, J. Jiménez, G. Arcos, M. Romero, and L. Urquizo, «Design patterns for the construction of online courses in a virtual learning environment», Ingeniare Rev. Chil. Ing., vol. 26, n.or 1, pp. 157-171, Mar. 2018, doi: 10.4067/S0718-33052018000100157.
14. M. Eradze, M. J. Rodríguez-Triana, y M. Laanpere, «A Conversation between Learning Design and Classroom Observations: A Systematic Literature Review», Educ. Sci., vol. 9, n.or 2, p. 91, Apr. 2019, doi: 10.3390/educsci9020091.
15. R. A. Reiser, Ed., Trends and issues in instructional design and technology, 3. ed., International ed. Upper Saddle River, NJ: Pearson, 2012.
16. R. A. Reiser and J. V. Dempsey, Eds., Trends and issues in instructional design and technology, 3rd ed. Boston: Pearson, 2012.
17. S. E. Smaldino, D. L. Lowther, C. Mims, and J. D. Russell, Instructional technology and media for learning, 12th Edition. New York: Pearson Education, Inc, 2019.
18. S. Chang, "The Systematic Design of Instruction," Educ. Technol. Res. Dev., vol. 54, pp. 417-420, Aug. 2006, doi: 10.1007/s11423-006-9606-0.

19. «meaningful-learning-ch-1.pdf". Accessed: May 20, 2024. [Online]. Available in: https://ugaedit.wordpress.com/wp-content/uploads/2012/08/meaningful-learning-ch-1.pdf
20. "PACIE Methodology: The Presence Phase as a Fundamental Element in The". Accessed: May 19, 2024. [Online]. Available in: https://www.eumed.net/rev/atlante/2018/01/gestion-aprendizaje-virtual.html
21. UNIR, «What are the functions of the tutor in educational centers?» [Online]. Available in: https://www.unir.net/educacion/revista/funciones-tutor/
22. Acosta Alberto, "Amazonia. Violence, resistance, proposals", Amazonia. Violence, resistance, proposals. Accessed: March 10, 2024. [Online]. Available in: https://journals.openedition.org/rccs/6004
23. MECAPACITO, "National Plan for Lifelong Learning", 2024. [Online]. Available in: https://mecapacito.educacion.gob.ec/plan-nacional-de-formacion-permanente/
24. Rosenberg MJ., e-Learning. Strategies for delivering knowledge in the Digital Age. New York: McGraw-Hill, 2001.
25. G. Navarrete, C. Morán, M. Guamán, M. Arteaga, and J. Torres, «E-learning as a tool for continuing education: A proposal for professional training in Ecuador», RISTI - Rev. Iber. Sist. E Tecnol. Inf., vol. 2019, n.or E18, pp. 14-25, 2019.