

# Dynamic Learning Environment for the blind people for the Faculty of Applied Sciences.

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**Summary:** This project consists in the design and implementation of a dynamic environment of learning for blind people, implemented in the blind people area of the library of the Técnica del Norte University, it aims to improve the education, training and teaching of students with visual disability. It is used the methodology of teaching - learning known as PACIE for the design of the virtual environment and the right structure of the content for use.

This methodology search to include the Information and Communication Technology in the education process to facilitate learning and personal and professional growth of the person.

**Keywords**—ATutor, Visual disability, Eva, E-Learning, PACIE.

## I. INTRODUCTION

Today the population faces great difficulties in accessing education, as not all people have the same cognitive and sensory abilities to gain entry to the centers of education in the country, for the simple reason of not having the appropriate infrastructure and the low didactic material.

Every effort employed to reverse this situation allows to have an educated population, capable of facing any challenge. A disability person don't search employment because they create jobs.

Technological advance and the use of virtual tools of mass education and interactivity, produces a dynamic learning environment that satisfies the needs that have in great measure the society blind to start the learning process.

This project is a pioneer in the development of virtual environments for the blind people.

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## II. BASIC CONCEPTS

### A. Disability

The organic law of disabilities of Ecuador mentioned in Article 6 the following:

“Article 6. - People with disabilities.- For the effects of this law is considered disabled person to all those who, as a result of one or more physical, mental, intellectual or sensory deficiencies, regardless of the cause that would originated, see permanently restricted this biological, psychological and associative capacity to perform one or more essential activities of daily life, in the proportion established in the Regulations.”[1]

### B. Web Accesibility

The web accessibility provides great benefits to people with visual disability who first time can access to information and content of the sites of interest. Also the accessibility does not influence only in a group of peoples with different capacities but search improvement the quality of web sites.

To count with accessible environments for education of people with visual disability should be taken into account the following aspects:

1. Font size. The environment must allow the increase in the font size.
2. Contrast colors. The site should be designed taking into account the color contrast allowing visual weight highlight the elements and viewing of.
3. Multimedia equipment. The environment must have sounds and images that will be helpful for correct navigating of the site.
4. Intuitive icons. It should include intuitive images of all functionalities of the site and this will help people with mental and visual problems.
5. Avoid scrolling. The site must be designed for people with mobility problems, therefor must be avoided long pages vertically and horizontally.
6. Shortcut keys. It is recommended the integration of keyboard shortcuts that provide mobility for the site, but keep in mind that should be two or three keys, such as ALT + G or ALT SHIFT + G, because if it is done

with more keys will bring another problem.

7. Intelligent Search. The site should have a searcher that interprets what the person wanted to write and give the option for correction.
8. The site must have a navigation menu that should be in the same place for that the user is not lost.

For a good use of accessibility for people with disabilities in the education is important that teachers, authors and all those involved in the process of academic formation are well informed and trained in the use of accessibility tools. [2]

### C. Electronic Learning

Electronic learning or also known as E-Learning is a learning method by distance or semi-face, which is characterized by educate and/or train students using technological tools, electronic media and the internet.

### D. Learning Management System or LMS.

Are platforms to manage and automate the process of academic formation of students, such as managing student data, registering users, create courses, store and manage content, provides tracking of learning, reporting, and ultimately enable communication and interaction between users. [3]

- Proprietary software platforms: WebCT, Teed, eCollege, Fronter, among others,
- Free software platforms: ATutor, Moodle, Claroline, Dokeos, swad, among others.

### E. PACIE Methodology.

PACIE is a methodology of teaching and learning that has as fundamental principles the creativity, socialization and interaction between participants of the process of education and teachers or tutors prepared, and the use of technology. [4]

#### Objectives PACIE Methodology.

PACIE methodology it aims to involve the TIC's in the process of academic formation, putting the teacher as the main body of the teaching - learning.

It also searches to facilitate to the teacher and institutions online tools necessary for the correct education, with the idea of learn doing and creating knowledge collaboratively.

#### Phases of the PACIE Methodology

The P.A.C.I.E methodology has 5 phases, these are expressed in each of his letters; P means presence, A is scope, C means capacitation, I mean interaction, E means E-Learning.

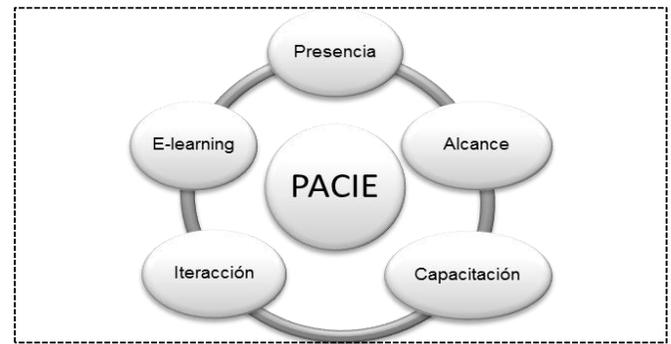


Fig. 1. Phases of the PACIE Methodology

#### Presence Phase ( P )

It is the first phase of the PACIE methodology, which relates with the visual appearance of the virtual learning environment.

The presence phase must provide the following aspects to EVA:

- Provide an aspect attractive visual.
- Use the same font, style and color for titles and information respectively.
- Use appropriate the informatic means online.
- Provide updated academic content and efficiency.
- Using the additional tools available on the web environment, such as animations, videos, images, presentations, chat, video conferencing, among others.

#### Scope Phase (A)

The second phase of PACIE is characterized by focus in the pedagogy of the EVAs .

The scope allows you to plan and set objectives that facilitate results adequate with the reality, which enable obtaining skills and abilities commensurate with the real environment results. Also in this phase should make proper planning of courses, areas, students, and educational institutions that will participate in the teaching – learning process. It is here that will be indicated that courses or careers will be held in the beginning, which group of people is will be educating, which teachers are totally prepared to teach a course. [5 ]

#### Capacitation Phase (C)

The third phase of PACIE is the capacitation and this refers to the training that should have the guardian or teacher to handle the job properly on the realization of the course .

The Capacitation phase has three important elements:

- ✓ *Technological Element.*- Refers to the evaluation of the use and management of technological tools, it is important to conduct training workshops thereof.
- ✓ *Communicational Element.*- For good interaction is necessary to have the mass media available, such as: email, mass messaging.
- ✓ *Pedagogical Element.*- Is necessary to train teachers able

to teach the classes with the best pedagogical practices.

#### *Iteration Phase (I)*

This is the fourth phase of the PACIE methodology and is the most important because it is based on the ability to learn by the use of activities and resources for sharing and working collaboratively with all members of the course. [5]

This phase has the following objectives:

- ✓ To promote the actual interaction between students and the tutor in an EVA.
- ✓ Avoid boredom and dropout students EVA
- ✓ Encourage the student to participate.
- ✓ Reduce the overload of activities.
- ✓ Provide learning virtual environments interactive and cooperative.

#### *E-Learning Phase (E)*

This is the last phase of PACIE, and is characterized by allowing the learning of students with the support and use of new technologies. The E-Learning enables integration between education and the TICs without neglected the pedagogical part. [5]

In this phase breaks the gaps of time, space and cost, because learning can be designed from anywhere, at any time and at reduced costs.

This phase aims to provide the following objectives:

- ✓ Know and assessment techniques available online.
- ✓ Mix online tutoring and practice mentoring.
- ✓ Optimize learning with the use of the resources available on the web.
- ✓ Automate assessment processes.
- ✓ Encourage the use of the tools of Web 2.0 and 3.0.

#### *F. Virtual Classroom*

The virtual classroom is a term that is used a lot lately in educational institutions to define a type of distance education associated technological means used to pedagogy.

Virtual classrooms are characterized by being designed in a totally flamboyant way for the student and assist him in the learning process by removing barriers such as time and geographical space..

#### *Structure of a virtual classroom according to PACIE*

The PACIE methodology establishes in the phase of interaction the structure with which must be designed the EVAs or virtual classrooms.

A virtual classroom is divided into blocks so that each block meets a specific function in the process of formation of the student.

#### *Block 0 or PACIE.*

This block is the essential part of the virtual classroom because in here the interaction among those involved in the learning process is performed, the cooperative knowledge is

generated and common experiences are discussed. [5]

This block is divided into three sections:

- ✓ *Information Section.* In this section will found all the information about the course as well as who is the teacher of the course, and how the evaluation will be conducted.
- ✓ *Communication section.* This section will found information about operation the classroom.
- ✓ *Interaction Section.* This section is the most important because it focuses on the social aspect, is promoted support and cooperative learning.

#### *Academical Block.*

The academic block is established as the center part of the virtual classroom, due to a sequence shown to follow generating knowledge , also all information, documents and links on the subject under study, also in this part are encouraged to the student interested in the content available. [5]

This block is divided into four sections:

- ✓ *Exposure section.* This section contains the theoretical information on the subject of study and also must have links with Documents and Information needed to complement teaching, such as: Videos, Images, PDF documents, among others.
- ✓ *Rebound Section.* This section is characterized by promoting the activities of self-criticism, here the advice provided through forums, wikis or other means of consultation is permitted for students interested in the course.
- ✓ *Construction section.* This section is used for student interaction through discussion forums, debates, allowing the student to hold his view with valid arguments, it generates knowledge.
- ✓ *Verification Section.* Known as evaluation section since it verified that the student has developed all activities scheduled in the virtual classroom.

#### *Breech Block.*

The breech block is at the end of the virtual classroom, which does not make it less important.

This zone is conceived in the culmination of the course, their aims is to give the student an opportunity to express its views on the course and maintain a culture of continuous improvement. Furthermore, this block serve for that those involved in teaching they can say goodbye. [5]

This block is divided into two sections:

- ✓ *Negotiation Section.* This section seeks to resume the themes pending or unfinished and so that way there is no empty in student, is also used to negotiate the evaluations carried out and are given the opportunity to comment on the course..

- ✓ *Feedback section.* This section is used for getting feedback from students about the teaching process, materials used, tools used in the course, which will help improve teaching in the virtual classroom.

### III. DESIGN AND CONSTRUCTION OF LEARNING ENVIRONMENT

#### A. Selection Tools

Once made the research of software tools that allow accessibility for people with some degree of visual impairment, the next step is to select the tools that will help build the application that meets the objectives of the project.

In the selection process takes into account two aspects; the first is the level of accessibility and usability that provide the tools, and the second is based on the philosophy of free software. The result of this analysis is to select appropriate tools that described in the following table 1.

Table 1: Selection of development tools.

Ítem	Tools	Characteristics
<b>Operating System</b>	<ul style="list-style-type: none"> <li>• Vinux</li> <li>• ( Windows Alternative )</li> </ul>	Free software distribution based on Ubuntu , designed strictly for people with visual impairment. Windows 7 is the Alternative.
<b>LMS o Learning Management System</b>	<ul style="list-style-type: none"> <li>• LCMS: Atutor.</li> </ul>	Designed from its appearance based on the standards of web accessibility W3C. It is the only LCMS fully accessible nowadays
<b>Screen Reader:</b>	<ul style="list-style-type: none"> <li>• ORCA y NVDA</li> </ul>	Screen Reader for Linux is free and comes installed and configured on the Vinux operating system. NVDA is the alternative to Windows s.
<b>Screen magnifier:</b>	<ul style="list-style-type: none"> <li>• ORCA magnifier.</li> </ul>	Screen magnifier for Linux, is included in the package Orca screen reader.
<b>Broser web</b>	<ul style="list-style-type: none"> <li>• Mozilla Firefox.</li> </ul>	Web browser that provides totally compatibility with the screen reader.
<b>Hardware (optional) Braille keyboard, Headset, Mouse, braille printer.</b>	<ul style="list-style-type: none"> <li>• Commercially available.</li> </ul>	Hardware that supports the learning process with the use of accessible tools.

Source: Own.

Selected tools have a direct relationship in the aspect of compatibility and integration of the learning environment.

#### B. Implementation of the Course with PACIE Methodology.

After completing the necessary settings on the platform are described below processes creating a learning environment following the PACIE methodology.

##### *Presence Phase (P)*

In this phase emphasis on the appearance of the virtual environment becomes the web resources that are used, the type of content, type and color of the text, updated which communicate knowledge, interaction through thematic forums.

Following the rules of visual web accessibility are taken into account several aspects that improve the functioning of the environment and its navigability as:

- ✓ Contrast colors.
- ✓ Size and font color.
- ✓ Accessibility with keyboard shortcuts.
- ✓ Audiovisual aids.
- ✓ Appearance.
- ✓ Content type.
- ✓ Focus on important information.

Table 2: Phase - Presence Custom keyboard shortcuts.

Key	Function
<b>F1</b>	Show and hide audio and visual aids
<b>F2</b>	Focus on the important content.
<b>F4</b>	Change and return contrast.
<b>F8</b>	Redirect to the home page

Source: Own.



Fig. 2. Presence Phase. (Using audiovisual help, Contrast infocus on content)

##### *Scope Phase (A)*

This phase is the planning and management of the content presented in the virtual environment, the objectives of the learning process with students are set, is determined one

person or department that is responsible for monitoring and promoting the use of the platform.

In this case the aim of the platform is to educate people with visual impairment, assess learning and promote social and educational inclusion.

For the which the entity in charge of incorporating content and ensure the use and operation will be the department or blind area of Tecnica del Norte University.

Resultado de Aprendizaje de la Asignatura	Excelente 100 %	Muy Buena 90 %	Buena 80 %	Regular 70 %	Deficiente 60 % y Menos
Habilidad para identificar, formular y resolver problemas que requieran soluciones de Ingeniería en Electrónica y Redes de Comunicación.	Excelente implementación de sistemas informáticos identificando sus requerimientos empleando sentencias y estructuras de datos	Muy Buena implementación de sistemas informáticos identificando sus requerimientos empleando sentencias y estructuras de datos	Buena implementación de sistemas informáticos identificando sus requerimientos empleando sentencias y estructuras de datos	Limitada implementación de sistemas informáticos identificando sus requerimientos empleando sentencias y estructuras de datos	Ineficiente implementación de sistemas informáticos identificando sus requerimientos empleando sentencias y estructuras de datos

Fig. 3. Phase Scope - Set Goals and Objectives of the Course.

*Phase Capacitation (C)*

The capacitation phase is geared to the instructor, the training in the use of the platform, research the web technologies , the level of knowledge about the courses they teach.

The teacher will have all the tools of the platform to design courses and relevant educational content, which will help the professional education

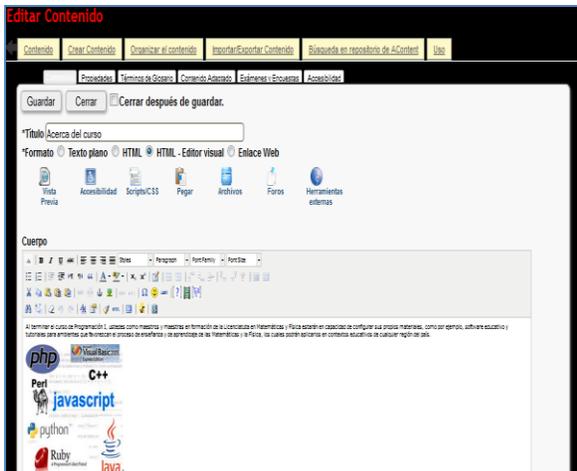


Fig. 4. Phase Capacitation - Content Creation.

*Phase Iteración (I)*

The fourth phase is the most important because it's expressed the useful to have the resources to be placed in courses, this content must be properly designed and structured to promote student training

The blocks with their respective sections are as follows

- Block 0 o PACIE.
  - Information
  - Communication.
  - interaction.
- Academic Block.
  - Exposure.
  - Rebote.
  - Construction.
  - Checking.
- Close Block.
  - Negotiation.
  - Feedback.

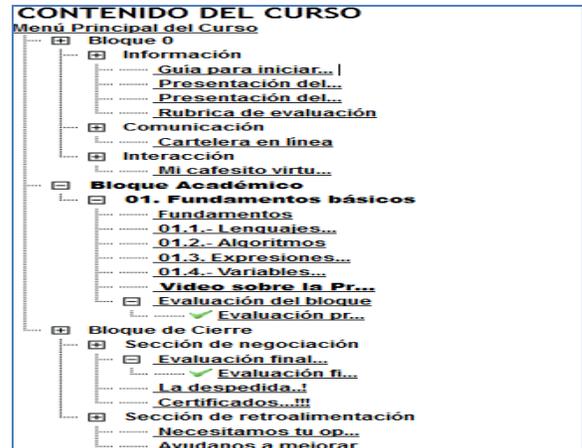


Fig. 5. Interaction Phase -Structure content blocks

*Phase E-Learning (E)*

E- learning It is the last phase of the PACIE methodology, it focuses on the pedagogy applied to the virtual classroom and technological resources used for the creation of content and be clear that you can enter at any time to the learning platform , for belonging to the new tools of ICT development is available all the time.

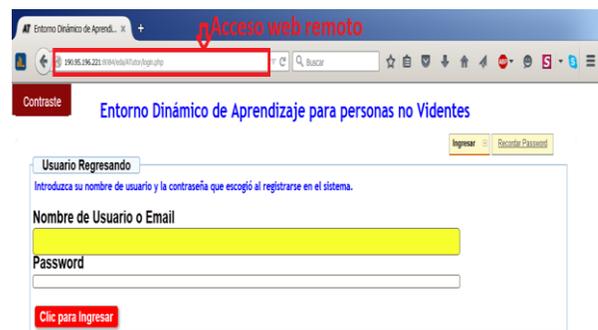


Fig. 6. Phase E-Learning. Unlimited access available geographical location and time



Fig. 7. Performance Testing, blind person registering on the platform

#### IV. CONCLUSIONS

There are many tools and learning platforms of free software used to exalt and improve education for people with visual impairment.

According to the theoretical investigation it determined that the different learning platforms that exist ATutor is the ideal type solve accessibility projects.

The ATutor platform is a tool that provides easy accessibility, necessary for the development of a learning platform aimed at blind people.

ATutor is the only platform fully developed with all standards of accessibility on the web and is available to the public.

The platform is easy to use and allows you to create well-structured instructional courses and still be managed, directed, supplied and modified by the guardians - teachers.

Moreover within each course assessments can be made of the contents, since its content is structured properly following pedagogical processes.

The educational content of each course is developed based on the pacie methodology, as this methodology is ideal for developing virtual environments, which emphasizes the course content, mentoring, interaction between the parties and the use of technology as a means to support pedagogy.

The methodology enables properly design and structuring educational processes through virtual campus, thus avoiding the educational neglect of education for people with poor visibility and total blindness.

There are programs to promote accessibility, such as screen readers, magnifiers content, language interpreters Braille, as ATutor LMS, web browsers accessibility tools, operating systems, among others.

To improve the project in the area of the blind, the University acquired equipment and materials of last generation, so it is not necessary to make a budget for acquiring them.

#### V. RECOMMENDATIONS

Implement training courses for blind people, therefore it is necessary to promote and demand the creation of accessible material for all subjects taught at the University.

Being at the forefront of technological accessibility tools

that are released to the market for use in the training process of students.

Promote the use of the platform since its goal is to provide quality information and easy to use. Not forgetting to feed and update course content to get the most benefit.

Exploit to the maximum the tool, as this can create courses and within these you can create forum, have a chat to social interaction, submit jobs, solve surveys, tests, among other things.

The teachers of the university are encouraged to use the PACIE methodology for the development of online courses, it is a tool with which to avoid monotony of today's courses, thus improving the appellant student access to the platform.

Give preference to people with disabilities in all institutions of the university, to introduce them in the daily activities that are currently relegated by their condition.

A college managers are recommended not to stop investing in equipment for the blind area of the university library, as a result of assimilation of information and acquiring new knowledge in blind people was improved. Promoting educational excellence provided by the institution.

#### VI. RECOGNITION

Special recognition expressed to the blind area of the Tecnica del Norte University and authorities; the opening provided to develop this project in their installations.

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