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Eduquito: Virtual Environment for Digital Inclusion of People with Special Educational Needs

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Abstract: Eduquito is intended to be a virtual environment for digital/social inclusion where people can exercise their citizenship with interaction and personal development. As a virtual space, it comprises a Learning by Project Environment which provides not only access resources for People with Special Educational Needs but also an array of special tools, which foster a process of creative dialogue as well as dynamic individual and collective development.

Keywords: virtual environment, accessibility; persons with disabilities
Categories: K.3.1, K.4.2

1 Introduction

In the process of social inclusion and overcoming inequalities, we have had the opportunity to observe the valuable contribution of the use of Information and Communication Technologies (ICTs). As we have already emphasized [Santarosa et al. 2007], the possibilities that the digital/virtual environments offer may affect, in a direct or indirect manner, family, professional, educational and/or social aspects of a person's life.

In regard to educational paradigms, we have highlighted in our published work [Santarosa 2006a][Santarosa 2006b], backed by 20 years of experience at the IT Center for Special Education (NIEE/UFRGS), the construction of digital/virtual learning environments called "constructivist", as opposed to "instructional" proposals, as well as pointed out the important contribution of these environments to the development and digital inclusion of Persons with Special Educational Needs (PSENs).

Clearly, the Internet should be characterized as a space for everyone and it can be used in the urgent and necessary task of expanding the creation of new virtual spaces of coexistence, interaction and development, providing digital and social inclusion for PSENs. Therefore, it is fundamental to consider the attributes of the concept of accessibility.

In this context, we present Eduquito, a virtual/digital environment for individual and collaborative work, which can be characterized as a space for the production and development of matters of interest by way of projects designed and managed by the

participants themselves, for interacting, exchanging ideas and bonding with other individuals with like interests.

Eduquito[1] was designed to be an open interactive space founded on concepts from Socio-Historical Theory [Passerino 2006][Santarosa 1997][Santarosa 1999][Santarosa 2001][Santarosa 2002a][Santarosa 2002b][Santarosa 2006a][Santarosa 2006b].

The distance learning educational environment Teleduc, a system that guides the creation, participation and administration of courses on the web [Santarosa et al. 2001][Santarosa et al. 2006], was used as a base for the development of this proposal, together with others distance education platforms that feature resources for on-line interaction and production. In contrast to Teleduc, Eduquito reveals itself to be an environment geared towards the development of projects, which may or may not undergo the mediation of a more experienced user (a teacher, a monitor, a colleague with more expertise), as well as an environment of coexistence which opens itself up for interaction and digital inclusion.

Another fundamental difference when compared to the Teleduc environment concerns the planning involved in the development of Eduquito in order to encompass easily accessible technologies that provide a virtual space for everyone, especially enabling the digital inclusion of PSENs.

The presentation of the aforementioned environment begins with a discussion on digital and virtual learning environments, exploring their use within various learning environments and going over some existing environment proposals. After that, we examine the subject of accessibility. Finally, we introduce the Eduquito environment and then close with some final thoughts on the work carried out.

2 Digital/Virtual Learning Environments – DLE/VLE[2]

The creation of DLE/VLEs is currently occurring at a rapid pace as is the production of advanced technologies. Also evident is a diversification in the manner in which they are employed to include educational spaces for information, training, interaction, communication and coexistence, allowing greater access to users, who then benefit in terms of learning, development and digital/social inclusion.

We have already pointed out [Santarosa et al. 2007] the different existing theories that have influenced the creation of these virtual spaces in the concept of learning and human development. Thus, the creation of DLE/VLE is influenced by these concepts, originating closed environments with instructional focus where the emphasis is on teaching, or open environments with constructivist focus where the student is the active agent of the process and the builder of knowledge. Each one of these virtual

1 Project funded by CNPq – MCT. The researchers: Dr Liliana Passerino, Dr Lizandra Estabel, Me. Eliane Moro took part in the development of this project as well as the graduate and undergraduate students: Cristiani Dias, Eduardo Estima e Fernanda Schneider

2 Various names have been used to refer to digital learning sites. We believe that Digital Environments is the broadest name as long as it is understood to include Virtual Environments. Because of the importance of the Internet, the initials VLE have increasingly appeared. We have opted to keep both - DLE/VLE, in order to avoid creating distorted interpretations.

spaces highlights educational paradigms with different theoretical references. Therefore, in the environment with an algorhythmical focus, the systems are based on Behaviorist theories while in the environment with a heuristic focus, learning by discovery is emphasized and is supported by Interactionist theories.

We could say that DLE/VLEs are scenarios that exist in cyberspace[3] and involve interfaces that favor interaction/communication including tools for autonomous activity and offering resources for individual and collective learning. The DLE/VLEs [Valentini and Soares 2005][Barbosa 2005], that synthesize the functionality of software for communication/interaction mediated by computer, are known by various names such as computerized learning environments, digital learning environments, virtual learning environments, "on line" learning environments, distance learning generating systems, collaborative learning software, web learning environments, e-learning, distance education platforms, coexistence networks, etc.

There is a trend to emphasize the virtual state of these environments, since the concern seems to be on digital inclusion with an aim at providing greater accessibility for all. In this way, DLE/VLEs are linked to the creating of learning strategies mediated by WEB tools and to the providing of learning by means of the construction of concepts and the interaction of student with educator, with colleagues, with the environment, and with physical and social building blocks of knowledge.

As we have already pointed out, the DLE/VLEs differ in their manner of functioning by epistemological conception; by the notion of how knowledge is constructed (acquisition) and how the individual learns. In this panorama, processes of interaction may be involved that attend to (or do not attend to) different styles of learning, such as: cooperative learning; learning oriented by discussions; student centered learning; project-based learning; challenge-based learning; problem-based learning; and discovery-based learning, among others.

Our approach is to plan coexistence and learning environments through projects that enable the individual to construct knowledge, whether that person is a scientist or someone operating at a meta-cognitive level, given that psychological research in recent decades has shown that how we learn does not respond to linear models of learning but rather to paths of integration, crisis and new synthesis of content learned, similar to the use of analog computers with the motors of inference of intelligent systems, not only from an individual perspective but also from the realm of social interactions.

Along these lines we have created a digital/virtual environment that has as its epistemological principle the idea that the learning process should be centered on the learner and his/her needs, should take advantage of digital technological resources (both hardware and software) and be based on socio-historical theory. Therefore, an interactionist/constructivist conception allows learners to set out from interaction with physical and social objects to the construction of knowledge [Passerino et al. 2006][Santarosa 2006b].

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3 Cyberspace is defined as the "new means of communication, which arose with the worldwide interconnection of computers", setting up a "new space for communication, sociability, organization and transaction, as well as a new market of information and knowledge" [Lévy 1999].

We shall refrain from explaining the epistemological concepts of a socio-historical theory [Vygotsky 1984][Vygotsky 1989][Vygotsky 1991] on which the creation of the environment is based, as it is sufficiently covered in the references cited, in order to focus on aspects related to the environment itself and to reinforce everything that has been recommended for the creation of these virtual/digital spaces which should contemplate: learning and development perspectives; construction of knowledge; encouragement to explore and discover; interaction/communication; exchange/collaboration/cooperation; autonomous learning; synchronous and nonsynchronous dialogues and conversation; promotion of higher mental processes; joint construction; digital and social inclusion and coexistence, among others.

Among the existing environment proposals we should highlight some that are widely used and which fall into the category of free software with open codes such as Moodle[4] and Sakai[5]. Also, among the proposals developed in Brazil, by way of research groups linked to universities, we could point out the aforementioned Teleduc[6] as well as the Rooda[7] environment.

Despite the fact that the versions of the most recent proposals like Moodle already conform to the regulations for creation of content available on the web, none of the proposals address accessibility for PSNs as a foundation for its development. In order to better understand the concept of accessibility, we shall review it in the next chapter of this study.

3 Accessibility

Accessibility means facilitating access to information and facilitating the interaction of PSENs with the digital/virtual environments through software and hardware. Accessibility is understood as a "synonym of approximation, a means to provide each user with interfaces that respect his/her special needs and preferences and enables the construction of an independent project that features a rupture with a model of society that is limiting, that subordinates and excludes groups of men and women from intelligent collectives."[Conforto and Santarosa 2002].

Accessibility can be linked to different areas. Focusing the possibilities of the application of this concept within Information and Communication Technologies leads to the following considerations: (1) accessibility to a computer which use access programs (software), which include different types of Technical and Technological Aids for use in accessing computers and peripherals [Hogetop and Santarosa 2002] or that can be specially programmed to access the Internet; (2) accessibility to a browser, which can be generic (Microsoft Internet Explorer, Netscape Navigator,

4 Moodle.org. Available at: <http://moodle.org>. Accessed on: Jan. 20 2009.

5 Sakai Project. Available at: <http://sakaiproject.org>. Accessed on: Jan. 20 2009.

6 Teleduc, developed by Núcleo de Informática Aplicada à Educação (NIED/Unicamp). Available at: <http://www.teleduc.org.br>. Accessed on: Nov. 07 2008.

7 Rooda – Rede Cooperativa de Aprendizagem, developed by Núcleo de Tecnologia Digital Aplicada a Educação (NUTED/UFRGS). Available at: <http://www.nuted.edu.ufrgs.br/nuted/projeto_rooda.html>. Accessed on: Dez. 10 2008.

Mozilla Firefox) or specific (like LYNX – a purely textual browser), and to WEB pages, which involve several dimensions like content, structure and format [Conforto and Santarosa 2002].

Seeking to provide social insertion to the digital world for people with special needs, international groups (W3C-WAI[8] particularly stands out) and national groups (Acessibilidade Brasil[9]), as well as companies, such as Microsoft[10] and IBM[11], propose or encourage adopting technical standards to be followed and software projects to be developed in order to enable accessibility.

4 Eduquito: Proposal for an Accessible VLE

The virtual environment Eduquito is presented here with expectations of serving the demands of accessibility, of making use of the methodology of project-based learning and of creating networks of coexistence and interaction. Let us begin with a description of the technologies involved in the development and of this VLE as well as an explanation about the relative challenges to accessibility found in its development. Finally, there will be a description of the players present in the environment and its organization by way of different tools, highlighting new resources added for PSEN accessibility.

4.1 Platform for Development

The Eduquito environment was designed after a web-based model, seeking ease of use, a user friendly and accessible interface, interactivity and independence of geographical location in its use. In order to access the system, the user needs to be connected to the Internet and the computer must have a browser. Access via browser allows ease of use besides making the environment more portable, since the users can access it regardless of the operational system of preference (Windows, Linux, Mac).

With regard to the technology used in Eduquito, notable is the fact that the development of the system was based entirely on the use of free software, thus avoiding additional costs relating to the acquisition of software licenses. More specifically, the environment uses the GNU/Linux operational system, configured to operate with the Apache web server. Integrated with this server is the data base MySQL, a DBMS which is fast, multi-platformed, easy to use and free for non-commercial use besides being an interesting alternative for applications that require only basic data base functions [Cardozo 2004]. MySQL allows the storage of all the data produced by the users as well as the data generated as a result of their interaction.

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8 Web Accessibility Initiative. Available at : <http://www.w3.org/WAI/>. Accessed on: Oct. 16 2007.

9 Acessibilidade Brasil. Available at : <www.acessobrasil.org.br>. Accessed on: Oct. 16 2007.

10 Accessibility at Microsoft. Available at : <http://www.microsoft.com/enable/>. Accessed on: Oct.16 2007.

11 Human Ability and Accessibility Center. Available at : <http://www-03.ibm.com/able/>. Accessed on: Oct. 16 2007.

The different functions of the system were implemented using the PHP (Hypertext Preprocessor) language as the programming language, integrated with codes in JavaScript and HTML (HyperText Markup Language).

4.2 Challenges in the Implementation of an Accessible VLE

The environment that Eduquito was primarily based upon (Teleduc[12]) exhibited countless barriers to PSEN accessibility, in view of the fact that this matter was not considered in its development.

The challenge then arose to detect and overcome those barriers by way of solutions that followed the recommendations contained in the document "Web Content Accessibility Guidelines[13] 1.0 - WCAG 1.0", proposed by W3C/WAI (Web Accessibility Initiative).

We should point out, as an example of this type of barrier, the structuring of the environment through the use of frames, which is a resource that offers a series of difficulties for users who interact with the computer using a Technology Assistant known as screen reader. In order to overcome this difficulty, there was a revamping of all the environment's interfaces and the navigating among them so that the frames were no longer used.

Another resource found on the base environment, and which also had to be replaced, concerned the use of floating menus, implemented using javascript and visibility properties of the *div* structure of HTML. This resource, found in most of the tools, does not allow for a suitable reading by the screen readers. For its replacement, there was a case by case analysis then it was substituted in most instances by icons that provided access to the function in question. It is worth noting that all the icons that were used had alternative texts so that they could be reproduced by screen readers.

The verification of the final environment's conforming to the recommendations contained in the document WCAG was done by way of automatic validation of its codes using a system know as DaSilva[14], an evaluator of website accessibility linked to the Acessibilidade Brasil association. Materials that did not conform to any of the recommendation's three levels of priority were duly corrected so that they could be considered accessible. The validation process of the environment was complemented through its use with user groups that had different profiles and types of needs, which served to point out aspects of difficulty in use and access of the environment. This stage proved to be fundamental, in view of the fact that many flaws, especially those to do with ease of use, cannot be detected by way of automated methods.

Besides these precautions, adopted to follow the recommendations mentioned, there was also a priority to implement accessibility resources considered necessary by the team after years of experience developing studies and assisting PSENs. These

12 Teleduc. Available at : <http://teleduc.nied.unicamp.br/>. Accessed on: Oct. 23 2007.

13 The WCAG presents detailed recommendations about the rules to be followed in the development of materials available on the web, so that they may be considered accessible.

14 DaSilva. Available at : <http://www.dasilva.org.br/>. Accessed on: June 25 2007.

resources were grouped together in one structure called the “acessibility bar” (Fig. 1), that is found at the top of the Eduquito environment.

Figure 1: Accessibility Bar

Noteworthy among these resources are the shortcut functions via keyboard which allow users with visual deficiencies or motor problems to move around easier within the three areas in the environment: tool menu (F key), accessibility bar (A key) and the content area (C key).

Options to decrease or increase font size of the text on the user’s screen were also made available, facilitating the use of the environment for people with an altered field of vision.

Another resource offered by this tool bar is a link to a video in Brazilian Sign Language (Libras), which shows the main information (similar to a help page) about the tool the user has accessed and also a link to an audio recording for the blind which presents the same information that is on the sign language video.

Finally, on this tool bar, there is an icon to switch on the tool for written sign language through a virtual keyboard which enables the production of material by people who communicate using the written version of sign language.

4.3 Users and Their Roles

In order for individuals to be able to interact with each other as well as use the resources of the system in a coordinated manner, it became necessary to define some categories of users that enable an individual to take on different roles. Listed below are the four categories of users present in Eduquito:

Coordinator: defined as a user who proposes a project and becomes the coordinator of the project. These users have access to the administrative area of the project, as well as to all the functions offered with each tool. It is a category essentially meant for learners that might be taken on by a mediator, as a more experienced person, when necessary to motivate the participants with greater limitations, the illiterate, among others.

Participants: defined as the users (learners) who come into the project because of interest in the subject and who may use the tools made available by the project’s coordinator.

Mediators: are the users responsible for the mediation tasks within the environment (usually a professor or a researcher) and who accompany the development of the project. The mediators have the same accessibility rights as the coordinators.

Administrators: users responsible for the environment’s administrative tasks, without being connected to any specific project. As part of their duties, they are in charge of accepting or rejecting new projects, creating spaces for them (always available), as well as tasks related to configuring data for the environment.

4.4 Interfaces and Tools

When it came to designing the environment's layout, the aim was to develop a proposal that was attractive to the user and to make sure it met the requirements of accessibility. The use of icons serves to reinforce the association of functions to certain signs; at the same time alternative texts are used for individuals who use screen reader programs or textual browsers.

The Project tool comprises the central element of the Eduquito environment. The other internal resources are grouped as tools of Interaction, through which users communicate among themselves in a synchronous or non-synchronous manner; Production tools, where the materials produced by the users are placed; Management tools, fundamental for the organization of activities to be developed; Presentation tools, through which the users can get to know each other; and Announcement tools, used to divulge information relevant to the project and general news.

All of these tools are linked to each other with a model of the structure shown below (Fig. 2). More details on the uses of each tool can be found at [Santarosa et al. 2007].

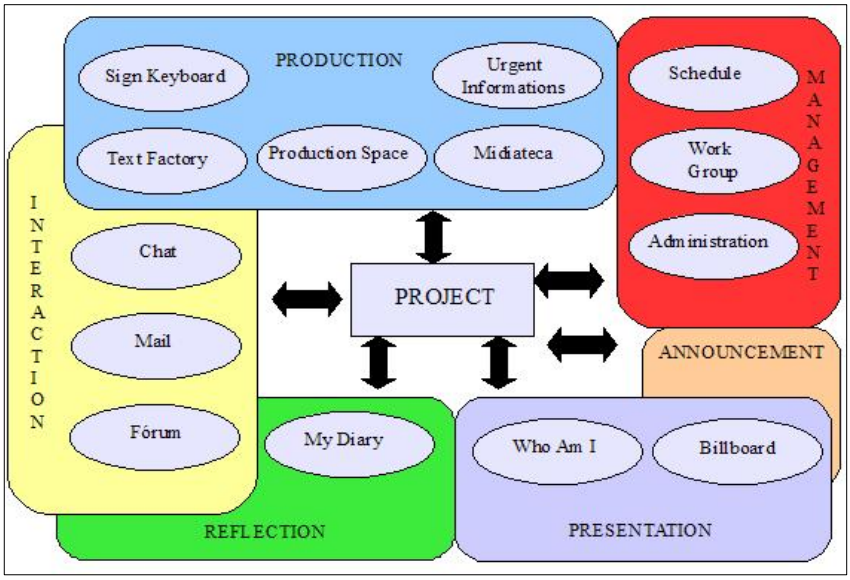

Figure 2: Funcional Framework of Eduquito

There is also the possibility of adding other tools to the Eduquito environment in order to expand the range of resources offered for the inclusion and the socio-cognitive development of its users. An example of this is the recent integration of two new resources. The first deals with a voice chat system which aims to provide synchronous interaction for users who may or may not have visual deficiency, thus expanding the potential for communication in the environment, since it already had a textual chat system.

Another recently integrated tool concerns a virtual keyboard for written sign language which aims to expand the production and communication resources for deaf people. This tool allows the creation of texts through signs associated to the letters on a keyboard as well as a selection of signs within groups that represent hand movements or facial expressions. Besides these two options for writing, the tool also offers a resource for free drawing of symbols using a type of paintbrush. The designs created by the users with this tool can be saved (in the form of an image) and be used with other Eduquito tools like Mail or in the Production Space.

We should point out that there is a tool, still in the implementation stage, which aims to serve as a space for textual production in different formats (stories, books, poetry, journals, bulletins, and comics among others), capable of adding multimedia resources and graphic animation to stimulate the creativity of the users in collective (or individual) production of materials, thus forming a library with writer output.

Although they may be found in other tools in the environment, we would like to highlight some essential features of this new tool:

Flexibility: the tool should enable the user to have total freedom in the creation of his document by way of alterations or in its format or in the use of personalized elements for the composition of the final result.

Interactivity: the tool should offer the possibility of interaction of the user with elements and content registered with the base of the system.

Collaboration: the system proposed here should enable the collective creation of multimedia documents developed through user interaction.

Accessibility: the process of creation of documents and the results generated through this system should meet the necessary requirements so that PSENs are able to access without disadvantage during its use. Therefore, it is sought, through the tool, to promote the integration of people with a variety of different needs.

Expansibility: the tool should allow for a permanent receptiveness of its multimedia base to new materials which can enrich the set of options for the creation of documents

Portability: the tool should offer the possibility that the materials produced with it can be exported to (XML, HTML) formats and be externally visualized there, including all the resources that were used in its composition. In addition, it should allow the possibility to import materials to the format so they can be edited within the tool.

Reusability: the system proposed here should be designed in a way that the elements it uses during the production of a document as well as the final result of the production, can be reused for the development of other documents.

The proposal of this tool aims to counter the lack of accessible technological options for the collective construction of texts or multimedia documents and thus seeks to reduce the exclusion faced by PSENs.

5 Final Considerations

We should point out the importance of the efforts carried out to offer virtual spaces of coexistence and accessible learning, which provide the socio-cognitive development of PSENs and favours the reduction of the process of digital exclusion of these individuals. There are also possibilities for those who do not have special needs,

promoting space for coexistence and exchange among a variety of individuals and groups.

Aware that a Society of Information could be built on three pillars of exclusion – (1) excluding those who cannot afford suitable technological means; 2) excluding those who, because of age or education, among other things, do not know how to operate ICTs and (3) excluding those who for some deficiency or situation of dependence lack access to technological resources – , we seek to provide free and accessible spaces which can be used in the most diverse contexts (family, educational, professional, etc.) with an aim to the continual reduction of these exclusion pillars, given that these barriers result in human collectives for whom integration into the Society of Information is hindered.

The solutions proposed here represent alternatives for a more profound reflection on Digital/Virtual Learning Environments, from a perspective of the development and inclusion of the groups mentioned above, focusing especially on those who serve as motivation for our research center: the PSENs.

It should be noted the proposals for VLEs/VDEs currently available generally display a limited concern with matters concerning PSN accessibility. This is a marked difference with the environment proposed here, in view of the fact that its design and development aim to overcome inadequate tools and to provide equal opportunities for all users. Therefore, as mentioned at various points in this study, some tools are in the process of development while others will be added at a future time as their need is identified. Research carried out into the use of the environment by PSNs is essential in this process.

We should be aware of the way digital/virtual spaces are built and used and should promote greater access for all. Better care might be needed when dealing with the development and autonomy of those excluded, such as the PSENs, so as to avoid the reproduction of existing traditional models that up to now have not delivered positive or adequate answers to address exclusion and discrimination in our society. The attitude of this society leads us to the idea cited by [Estabel et al. 2006], that it is our own society that is deficient, "one that excludes or hinders the inclusion of PSENs in a society made up of so many differences."

To provide access to the VLEs/DLEs would allow us to hear and give a voice to the grand diversity of all mankind, and would be an initiative of the highest priority for the construction of a truly inclusive society. To assure that the benefits of these environments be available and accessible to all would constitute, in the context of modern society, a social and ethical imperative.

We seek, therefore, to advance toward the building of a society where every individual, regardless of personal talents or flaws, has the same opportunities for growing and living as do other citizens.

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