

# Mastering of hypermedia resources by virtual learning communities: possibilities and constraints for interaction, communication and construction of network knowledge

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**Abstract:** The purpose of this paper is to present the procedures and some of the results from the investigation on the use of hypermedia resources for the construction of network knowledge. These resources, available in a distance learning support environment, are used for the process of interaction and production of knowledge through a virtual learning community (VLC) under formation. This VLC aims at providing a collaborative environment equipped with multimedia resources focused on information, communication and continuing education for community health agents<sup>[1]</sup>, as well as nurses, physicians, teachers and other people who work in public establishments which offer access to Information and Communication Technologies in the city of Pedreira in the countryside of São Paulo. In this context, collaborative learning situations are shaped where users/learners master procedures, strategies and multimedia resources available and make “products” using audiovisual aids. The “products” are presented, discussed and revised by the group to be later distributed to and shared with the relevant community. Based on such activities, it was possible to understand that the use of audiovisual aids in virtual learning environments (i.e., tools which enable different forms of expression and the establishment of the distance communication among people on the Web through the joint use of visual and sound components) are able to boost the learning process by overcoming the training constraints typically found in traditional models and thus expanding the range of possibilities for the construction of knowledge.

**Keywords:** Virtual learning community, Digital proficiency, Social network, Hypermedia interaction, ICT

## Introduction

This study is part of a doctoral research project currently being conducted. The key rationale is the massive use of Information and Communication Technologies (ICT) in nearly all fields of knowledge and in several professional sectors as well as the emerging need to clarify the contribution of their resources to situations where users adopt an active role in the process of discussing, preparing and producing content. There is a particular interest to conduct more thorough investigations on the critical and creative mastering of ICT and the impact of ICT use on the social and cultural development of the stakeholders.

The impact of ICT on society has become an extremely relevant topic nowadays. In all sectors of our daily lives, ICT has various implications covering the economic, political, cultural and, particularly, social aspects. Characteristics associated with work, entertainment, culture, learning and means of network communication undergo constant transformation. The effects of those changes are widely described by researchers in a number of fields of knowledge. In the social arena, for example, De Kerckhove (1999), Castells (2000, 2001), Mattelart (2002), Lemos (2002, 2004), Levy (2000), and Rheingold (2004) stress their effects on society. In the communication field, Salaverria (2005), Wolton (2000), Orihuela (2002), Scolari (2008), Piscitelli (2005), to name a few. Cognitive aspects have been investigated by Assmann (2000), who describes unprecedented transformations where “human learners may become part of *cognitive ecologies*” (p.27). In those cognitive ecologies, the knowledge starts to be arranged according to what Pierre Lévy (1998) referred to as *collective intelligence*. Barbero (2003), on the other hand, makes an analysis of politics and culture that broadens the view as to how the “*medios ciudadanos*” (citizen media) foster the network communication providing new social and political visibility to the communities that use those citizen media.

We therefore believe that a user who reaches a certain critical degree of mastering of computer skills may become the producer and distributor of content. According to Deuze (2008), such content may range from sending an instant messaging communication to the production and posting of materials in blogs, videoblogs, mobileblogs, podcasts and other means that allow people to gather in communities, post stories and debate topics, and even original content may be produced. In this regard, more than being merely logged in, people may be generating an increasing amount of knowledge from mutual collaboration. This social aspect found in virtual learning communities is also highlighted by Rodríguez Illera (2007). To this author, learning “has a highly contextualized nature and is regarded as the result of a collective situation rather than as a merely individual or personal product” (p.117).

We may therefore say that hypermedia resources pave the way for the development of an active audience who is able to interpret and interact with the information presented in various ways and transform it so as to suit their own needs as well as the requirements of the group to which they belong.

There are many types of roles that can be played by users when they interact in a virtual learning community using this sort of resources. Should they adopt the role of *prosumers* (Toffler, 1980) – producers and consumers concurrently – such active users might contribute with different types of content and at different levels on the network. They may create their own content and take part in the expansion, selection, distribution, edition and/or modification of the content produced by other

users. Thus, in addition to *producing and consuming* materials, they also develop different interactive activities with these and other participants in the virtual community.

As regards to the communication-related aspects, digital technologies - in particular ICT-based technologies - enable the integration of different forms of communication used by society. Those which result from interpersonal communication and those arising out of mass media can coexist in tandem. In addition to these, there are also the hypermedia, which are specifically developed on the Internet and that, supported by multimedia resources and hypertextual structures, generate other communication flows which foster network communication (multidirectional).

According to Castells (2000), the potential integration of texts, images and sounds in a single platform which allows for multiple interactions at any moment (real-time or not) via an openly accessible global network fundamentally changes the nature of communication. For López García (2005), the ways to communicate on the Web get fully developed and integrated into an ecosystem that is highly hybridized. Therefore, a large number of “cognitive human agents may interact in a single process of construction of knowledge” (Assmann, 2000, (p. 14)). The author claims that ICTs unlock the cognitive potential of the human being and enable “complex cognitive and collaborative mixings”.

*“This means that the information and communication technologies are converted into a constituting element (and even an instituting one) of our ways of looking at and organizing the world ... What is really new and unprecedented about the information and communication technologies is the cognitive partnership they are beginning to form in the relationship that the learner establishes with them.”* (Assmann, 2000, p.15).[\[2\]](#)

As regards this study in particular, which prioritizes the participants' involvement to boost learning[\[3\]](#), the theoretical perspectives which guide the investigations particularly adopt Vigotski's (2001) socio-cultural orientation. These theoretical perspectives were chosen because they indicate and acknowledge the importance of interaction for the knowledge construction process. Another concept involved is the lifetime learning through continuing education. According to Valente (2004), learning takes place throughout the process of continuous education where stakeholders can learn as a group, collaboratively, reflecting over their own experiences and expanding them by adding new information.

Thus we defend the idea that encouraging people in the process of digital inclusion to use ICT should be linked to the availability of and access to the resources as well as to a methodological proposal for learning the technologies which would comprise the specificities and peculiarities both of the users and the reality in which they operate. We believe that ICT use can be learned in actual and concrete applications of the resources available for the development of projects and/or products, individually or in groups, based on the learners' interest (Valente, 2001).

We can therefore assert that ICTs, especially hypermedia communication tools, hold the potential of fostering the establishment of bonds between people who, albeit being physically and geographically distant, share the same interests and/or objectives. In addition to electronic mail, discussion forums and chat rooms, other communication and social mediation technologies are created every day. These include social networks which are established in virtual environments, online game platforms, blogs, photologs, videoblogs. They are regarded as elements of temporal, special and mental organization that can configure, modify and classify the types of relationships set up among the stakeholders and they carry aesthetic, social and political possibilities. Among

them, virtual learning environments, which are specifically used to promote distance learning through the web, can be used to combine, in a single framework, tools which provide the participants with a means to communicate and express themselves via audio and video aids, as well as text-based communication. These environments are especially developed for information and the continuing education of the stakeholders, devised to foster collaboration among participants and favor the interaction and construction of knowledge through the use of specific tools and robust multimedia interactive resources.

Although ICTs are present in nearly all fields of knowledge and in many professional sectors, there is still a predominant reductionist interpretation of the contribution of their resources to informal learning situations and of the impact of such use on the social and cultural development of ordinary people.

Concerning contexts related to Digital Inclusion, that is, to non-formal learning situations intended to foster the mastering of ICTs by digitally-excluded people, most solutions prioritize the access of these people to the technology. In our understanding, the discussion of processes related to the democratization of ICTs should consider that access to ICTs does not ensure that they are meaningful, let alone proficiency with or effective use of the resources available (Rodriguez, 2006).

The efforts made for the development of strategies especially focused on the mastering of ICT by digitally-excluded communities include the training of their members in the effective use of those resources, in the sense employed by Gurstein (2003), so that ICTs can help individuals accomplish their personal objectives and those of the group they belong to. Therefore, it is expected that the use of audiovisual aids in virtual learning environments can boost the learning process by overcoming the constraints typical of the traditional models and expanding the possibilities of interaction and construction of knowledge. These audiovisual aids are tools which enable different forms of expression and the establishment of distance communication among people through the Web, by means of the joint use of visual aids (signs, images, drawings, graphs, etc.) and audio aids (voice, music, noise, onomatopoeic effects, etc.).

Therefore, this study aims at understanding the possibilities and constraints of hypermedia resources, which enable the exchange of information, communication and collaborative distance learning, favoring interaction, different forms of expression, content production and the construction of knowledge among the participants of a virtual learning community. This virtual community is referred to as Re@ge – *Rede Virtual de Agentes* (Virtual Network of Agents)[\[4\]](#) - and has been set up to function as a collaborative site equipped with multimedia resources oriented to information, continuing and distance education for (digitally-excluded) community health agents, physicians, community leaders, teachers and other individuals associated with current Digital/Social Inclusion projects in sites that provide public access to ICTs in the city of Pedreira – São Paulo (Brazil).

This paper aims to contribute to the joint construction of knowledge and strategies which may provide support to other conceptual approaches for the use of hypermedia resources in virtual learning contexts.

## **METHODOLOGY**

The methodology used was based on the *research-action* process, since the study intended to investigate and document a real-life situation where a group of people performed guided actions in order to foster the mastering of audiovisual aids for the development of multimedia content and the

establishment of a virtual learning community. In this type of investigation, the researcher is not an observer of the reality under investigation but rather an active participant in the process, where he is involved with all participants in a collaborative and participative manner (Thiollent, 1996). The data collection tools used were semi-structured interviews (Triviños, 1987), participative observation (André, 1995) and field logs (Neto, 1994). These tools allow for the monitoring and the recording of information throughout the entire process. Audio and video recording activities were also used to complement the impressions recorded in the field log.

Initially, in order to understand and draw the profile of the group involved, a script was prepared to serve as a guideline for the interview. It included questions on how members of the group actually used ICTs in their personal and professional lives; the way they believed they learned how to use those resources; the degree of proficiency in the use of computers and the Web; and the experience they acquired during the development of the group activities. These data were collected, analyzed and used to develop activities for face-to-face and remote meetings held on a weekly basis for a period of 6 months.

In a second stage, an interpretative analysis of the content was conducted, with content being appropriately categorized. High volumes of data were broken into smaller units to be later re-grouped into categories whose new associations led to standards, topics and concepts (Bradley, 1993).

We chose to work with the data gathered, ranging from the raw data to the data resulting from the analysis, interpretation and synthesis. Overall, we conducted a preliminary analysis where the data collected were ordered and the most significant elements found were properly identified. This process provided us with a global view of the data. Afterwards, based on interpretation, the analysis categories were outlined and the meaningful units and the inter-relationships established among them were identified. Part of the activities was developed using information technology resources in a virtual learning environment. The system automatically recorded these actions using devices specifically developed for this purpose. The possibility of recording these actions was an important resource employed to assess the evolution of the hypermedia interaction established among the participants of the virtual community. A future plan is to use the CHIC (Cohesive Hierarchical Implicative Classification) software to support the analysis of this large amount of data so that the categories identified will be then subjected to a multidimensional statistical method, which displays the emerging patterns in “similarity trees”, according to their classes and levels (Prado, 2002), so that the relationship between those emerging patterns can be analyzed.

## **DEVELOPMENT**

In this topic, we will present the activities developed in the field during the first stage of the research. The context will be briefly described, highlighting the infrastructure, equipment and resources used, the population of the study as well as the procedures adopted to conduct the investigation. We then provide the details about the strategies applied for the establishment of the virtual network, describing the network from its inception up to its actual consolidation through the hypermedia interactions experienced by the early participants of Re@ge.

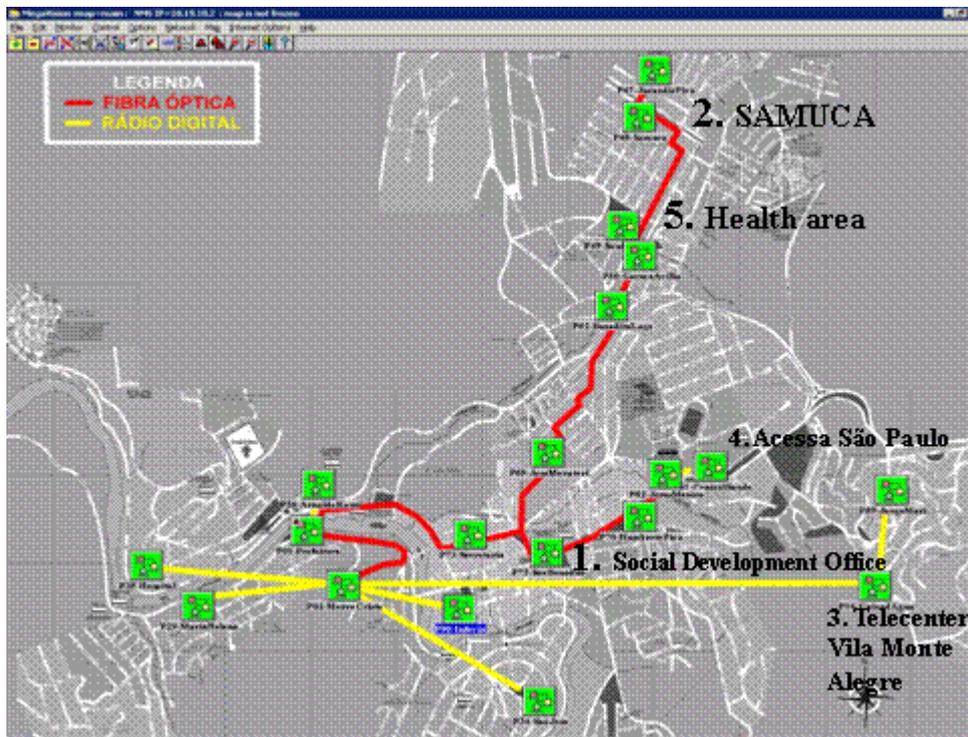
### **Context of Stage 1**

This stage lasted 6 months and the face-to-face activities were carried out in one of the public sites that provided access to ICT located in the city of Pedreira, in the countryside of the State of São Paulo (Brazil), called the Vila Monte Alegre Telecenter (GESAC<sup>[5]</sup>).

## Infrastructure, equipment and resources

The telecenter was chosen as the headquarters for the project because it provided the appropriate infrastructure for the implementation of part of the planned activities. There was also a room with 10 computers with a broadband Internet connection, and other multimedia technologies such as datashow, a TV set and a DVD player.

In order to provide broadband Internet access to users of the Vila Monte Alegre Telecenter and other public sites, the city of Pedreira has cutting-edge technology through *Infovia*[\[6\]](#) and wireless network, as shown in Figure 1.



**Figure 1:** Illustration of the connection network that uses fiber optics and radio in the city of Pedreira

With such an infrastructure, Pedreira is brought up to the level of a “digital city”[\[7\]](#), that is to say, the city equipment enables the connection of different sectors to computer resources and provides broadband access to the population.

Nevertheless, a city is regarded as “digital” not simply because of the existing technological infrastructure to provide ICT access to all citizens, but as well these resources have to be actually used by people so that the community as a whole can be consolidated and emancipated.

In addition to the technological infrastructure available at the Vila Monte Alegre Telecenter, the laboratory of the Preventive Medicine department of the Medical School and Lipacs[\[8\]](#) lab, installed at the Department of Multimedia, Media and Communication of the Institute of Arts, both located at the State University of Campinas (UNICAMP), in Campinas – SP, were also used to conduct hands-on virtual activities in this research stage.

From the virtual perspective, Re@ge was implemented based on the hypermedia resources available in the Tidia-Ae/Sakai[\[9\]](#) environment of Lipacs, with a limited number of participants, to conduct the studies required to define an environment and a methodology that could meet the

specific needs of the participants and of the activities developed in the virtual community that was being constructed.

At that point, Re@ge also relied on a Digital Inclusion channel called “Vila na Rede”[\[10\]](#), an inclusive social network developed as part of the project *e-Cidadania*[\[11\]](#) (*e-Citizenship*). This was the collaborative and hypermedia environment where some users who participated in the Digital Inclusion actions developed at the Telecenter virtually met with other network members.

## Relevant Population

In addition to the researchers involved, a group of 15 community health agents, one nurse, one physical educator involved in the *Programa Saúde da Família (Family Health Program - PSF)*[\[12\]](#) in the city of Pedreira, and 2 help desk agents involved in on-going Digital Inclusion projects at the Vila Monte Alegre Telecenter took part in this first stage of implementation of the virtual community pilot initiative. So that Re@ge could be truly referred to as a “Learning virtual network”, it had other project partners, such as a group of physicians and students from the Preventive Medicine Department of the Medical Sciences School of the State University of Campinas (FCM-Unicamp), a physician from São Paulo Hospital and a group of professors and graduate students from the Department of Multimedia, Media and Communication of IA-Unicamp. These partners joined the network informally, interacting with the group to discuss relevant topics and to allow proficiency in multimedia techniques. Thus, in a truly interactive system, it was expected that Re@ge would contribute and receive contributions through joint hypermedia actions and the involvement of all stakeholders.

Geographically speaking, in addition to Vila Monte Alegre, the following neighborhoods of Pedreira were involved: Jd. Andrade, Jd. Marajoara and Jd. Triunfo. So as to better understand the composition of this initial group, we divided participants into two teams:

1. Group of agents: composed of the 15 community health agents, one nurse, one physical educator and 2 Telecenter help desk agents.
2. Group of virtual partners: composed of 2 physicians who participate in the network, students and teachers from the multimedia field.

The two groups interacted with the investigators throughout this stage. The group of agents (group 1) participated in face-to-face and remote activities and the group of virtual partners (group 2) took part only in the remote activities.

## Procedures

Re@ge was gradually implemented with the purpose of optimizing the resources available and respecting the limited time available for participants to master these resources. At the same time, financial investments were made to complement the available infrastructure. Scientific resources were directed to provide the technical and educational skills required to train the groups involved so that the implementation of the network could begin. The following procedures were specifically adopted:

### 1 Complementing the existing infrastructure:

As a complement to the existing technological resources of Vila Monte Alegre Telecenter and in order to better equip the user groups who participated in the project, the following items were purchased and made available:

- Equipment and consumables (*WebCam*, microphone, headphones and loudspeakers), which were properly installed and configured to be used at the Telecenter;
- Equipment (digital camera, Mp5 player) required activities to be conducted by users, such as collection and recording of audiovisual materials in the “field”.

## 2. Technical and educational aspects

The following technical and educational activities were conducted with the participants:

- Meeting to discuss and adapt the distance learning environment Tidia-Ae/Sakai to accommodate a virtual learning community (Re@ge) under formation;
- Definition of specific resources (*wikis*, Blogs, Forum...) and of the procedures to be followed in the use of these communication resources and in the collaborative construction of the content to be addressed;
- Testing of specific hypermedia resources to be used in the “Multimedia Forum” available in the Tidia-Ae/Sakai environment;
- Definition of the criteria, procedures and standards for the use of available resources.

## 3. Training of stakeholders

Face-to-face training activities with the group of agents (group 1) were often held during the whole process and took place concurrently with the activities on the network, which involved the two groups.

For 6 months, during the first stage of the research, 20 face-to-face meetings were held at the Vila Monte Alegre Telecenter, once a week, with a 1,5-hour duration each, as shown in Figure 2.



**Figure 2:** Group of community health agents in a face-to-face workshop at Vila Monte Alegre Telecenter – Pedreira – SP (Brazil)

The virtual meetings were previously scheduled and relied on the synchronous and asynchronous tools available at Re@ge and on the support of Skype<sup>[13]</sup> for voice-based communication.

Here is a summary of the activities that were developed:

- 📁 Face-to-face workshops for digital literacy of the group of community health agents and nurses – Full Digital Inclusion – planning, execution and evaluation according to the characteristics and needs of each individual;
- 📁 Remote workshops to train virtual partners in the use of tools that were available in the environment;
- 📁 Face-to-face workshops on the use of the audiovisual aids available;

-  Face-to-face and remote workshops to define, discuss and prepare multimedia content according to the interests of the participants;
-  Free access to computer resources with the support of Telecenter help desk agents.

#### 4. Creation of the framework to provide support to Re@ge

For the implementation of the pilot virtual community, a distance learning environment was created and organized so as to provide the required support for a high level of interaction among the participants of the virtual community which was about to be set up. As initially planned, support was found in the resources available in the Tidia-Ae/Sakai environment implemented on the Lipacs server.

At first, two participants who worked as Telecenter help desk agents registered on Re@ge. They represented the groups involved in the Digital Inclusion activities. The idea was that these groups would interact with the Re@ge virtual community. Those participants helped determine the arrangements required for this environment to accommodate the pilot virtual community. This arrangement established two face-to-face meetings in which it was discussed how the environment tools and spaces for interaction could be arranged.

Already in the first meeting, it was found that the *Tidia-Ae/Sakai* environment offered the required elements for the establishment of a virtual learning environment because it enabled the interactive spaces to be organized as pages on a website. It was therefore established that, in order to better cater for the needs of the relevant target audience, tools would be organized in “pages” according to the role they played in the interaction. It was also decided that each “page” would use an action verb to represent the activity to be performed.

In the second meeting, the Re@ge website was created and set up inside the virtual learning environment to host the virtual community that was being formed. Synchronous and asynchronous tools required for participant interaction were also chosen and grouped on different pages. Each page was then identified with an action verb which represents the possible actions to be conducted there. Figure 3 shows the interface created on the Re@ge website, as well as the pages displaying the set of tools available for the network.

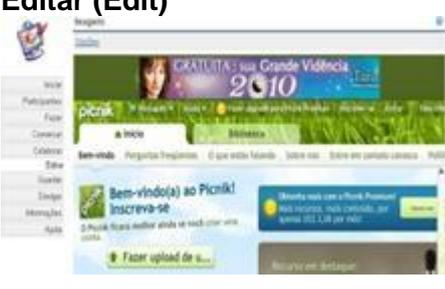


**Figure 3:** Interface of the Tidia-Ae/Sakai environment installed on Lipacs Server: details of the Re@ge website – Virtual network of agents - <http://www.lipacs.iar.unicamp.br:8080/portal>

Considering the fact that the structural arrangement of the software was flexible, we were able to group, in each page, the tools required for the interaction among the participants and these participants along with the constructed content. The environment was then “shaped” as a virtual learning community, that is, to foster the consolidation of the network as a hypermedia site for sharing ideas and constructing knowledge. Table 1 below shows all the pages created and the corresponding sets of tools defined for each type of planned action.

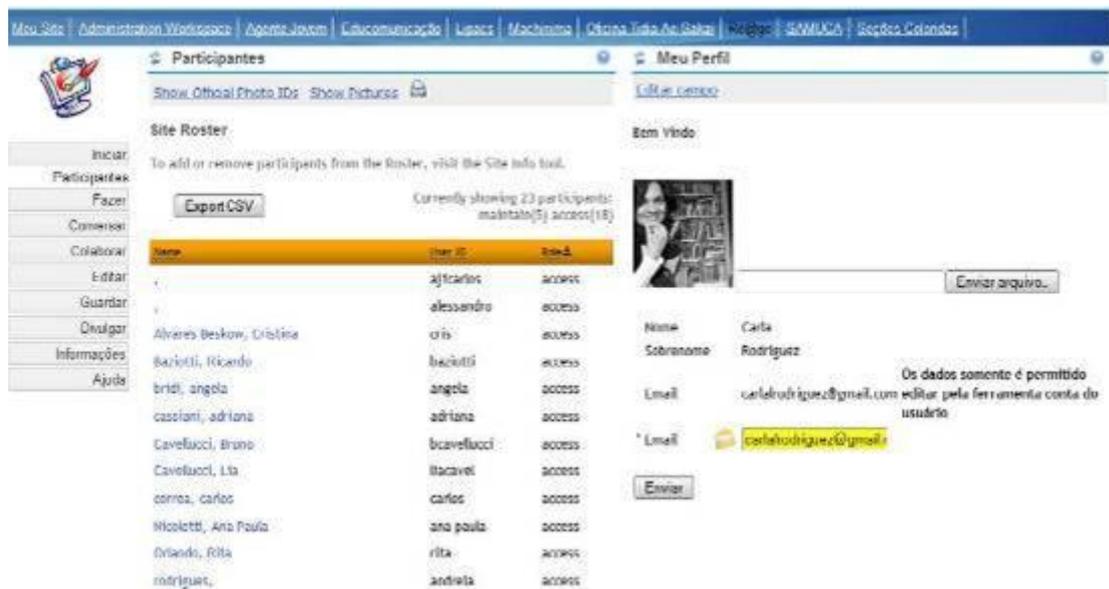
**Table 1:** Pages and tools available at the Re@ge website in the Tidia-Ae/Sakai environment

Action (Page)	Tools	Type of Use	Note
<p><b>Iniciar (Start)</b></p> 	<p>Notice, Calendar and Online status</p>	<p>Overview of what is currently going on at Re@ge; Follow-up on the activities recorded in the Calendar log; Identification of online participants; Reading of notices.</p>	<p>Enable users to receive <b>notices</b> and follow up on the project schedule/agenda.</p>
<p><b>Participantes (Participants)</b></p> 	<p>List of individuals registered on Re@ge website</p>	<p>Information on the profile of participants.</p>	<p>Each participant can post his/her own information, add a photo and inform his/her email address.</p>
<p><b>Fazer (Do)</b></p> 	<p>Schedule</p>	<p>Schedule face-to-face and virtual meetings and make activities available.</p>	<p>Face-to-face and virtual meetings are scheduled for specific dates. The <b>schedule</b> is accessible to everyone on the Start page.</p>

<p><b>Conversar (Chat)</b></p> 	<p>Chat, Messages, Notices</p>	<p>Synchronous interaction (chat) and Asynchronous interaction (Messages and Notices)</p>	<p><b>Bate-papo (Chat)</b> allows several chat rooms to be created. All participants can take part in the chats. In <b>Messages</b> and <b>Notices</b>, it is possible to create opportunities for debate over different topics in an asynchronous manner, that is, it does not require simultaneously online availability of all users.</p>
<p><b>Colaborar (Collaborate)</b></p> 	<p>Multimedia Forum, Wiki, Blog and Glossary</p>	<p>Asynchronous interaction both individually and collaboratively</p>	<p>In the <b>Multimedia Forum</b>, a number of different topics are debated using different types of posting systems (text, audio, photo and video). In <b>Wiki</b>, the content is jointly constructed by all participants. <b>Blog</b> offers the possibility of individually posting and communicating any content. The other participants may comment using the posts. A <b>Glossary</b> presents a list of terms which are developed throughout the project.</p>
<p><b>Editar (Edit)</b></p> 	<p>Images (external link to PicNik)</p>	<p>Meet the needs which are not satisfied using the tools available in the environment.</p>	<p>In this case, we will use <b>PicNick</b> to edit the photos. Other resources will be available in the future.</p>

<p><b>Guardar (Save)</b></p> 	<p>Folders (individual) Repository: Re@ge Resources</p>	<p>In individual folders, each participant can save and share their files. In Re@ge repository, various types of content are available for general use.</p>	<p>A participant can only save, edit, delete files of his/her own <b>folder</b>. In the <b>Public repository</b>, materials for general use are posted by participants registered as “Maintain”.</p>
<p><b>Divulgar (Sharing)</b></p> 	<p>External links to: Vila na rede, The Brazilian ministry of Health, ACS Mobilização, Acesa São Paulo, Livro Clip.</p> <p>Podcasts and presentations.</p>	<p>Information and news available and accessible through different channels, such as: sites, PodCast, Blog and slide presentations</p>	<p>For the Re@ge project, information sharing focuses on pages related to health and education. The <i>Vila na rede</i> digital inclusion channel is also listed.</p>
<p><b>Informações (Information)</b></p> 	<p>Informative content about Re@ge and the list of participants</p>	<p>Access/change Re@ge information; access/change list of participants</p>	<p>When accessing as “maintain”, it is possible to set up the layout and the tools. The learner is limited to viewing the information.</p>
<p><b>Ajuda (Help)</b></p>	<p>Sakai help</p>	<p>Answers to tool-related questions</p>	<p>Help is in English.</p>

The environment was initially used by previously registered help desk agents of Telecenters as a repository of activities under development. Later, other network participants created their own accounts. Figure 4 illustrates part of the list of active network participants.



**Figure 4:** Part of the list of Re@ge website participants on Tidia-Ae/Sakai-Lipacs

After participants registered on Re@ge, the purpose of each face-to-face meeting was to encourage them to master the audiovisual aids available so that the group could use them critically and creatively. All skills practiced by the participants at the Telecenter were later applied in “field” activities and the results were discussed in virtual meetings.

The *Cronograma* (*Schedule*) tool, as shown in Figure 5, helped registered agents to schedule and monitor activities.



**Figure 5:** Schedule of Re@ge activities on Tidia-Ae/Sakai-Lipacs

For “field” activities, referred to as “Daily Life Logs”, the tools included a digital camera and an Mp5 player, acquired [14] and put to use in order to capture audio, video, and photos by project participants, who took turns using the equipment. They recorded their own actions performed in the work environment, conducted interviews with the families served by the public health system, documented the activities of other members of the Family Healthcare Program team in the primary healthcare units. The material gathered was taken to the Telecenter to be discussed, adapted and posted on the virtual network.

## Hypermedia Interactions

The content discussed and prepared collaboratively on the network is related to education and health promotion. The topics chosen, such as teenage pregnancy, high blood pressure and diabetes, senior citizen care, among others, come from the direct contact of the group with the community, either during “field” activities and/or from the interaction via “Vila na rede” network. Collected in different formats, namely audio, video, photo and text, this content became “social and educational” multimedia materials, such as folders, web audio, documentaries, digital booklets, newspapers, games, etc. which were later shared with the community through several interactive channels according to the access choices available. Here are two scenarios that show examples of these actions: **Action 1 - Re@ge Orient@** and **Action 2 - Multimedia Forum**.

### 1. Action Re@ge Orient@

It was decided that the first action of Re@ge would be to raise the awareness of the community about the services provided by the Family Healthcare program. This need was reported in contacts established by the group with the families that used healthcare services and it was also described by other professionals who worked at the primary healthcare units, since it was realized that the population was not aware of the services provided by the Family healthcare program team. As a consequence of this lack of information, unnecessary services were provided, unrealistic work routines were adopted, leading to work overload and, consequently, user dissatisfaction.

For the virtual interaction, *Chat* and *Wiki* communication and collaboration tools were used. Figure 6 shows a Chat section with the participants discussing the first “Re@ge Action”.



Figure 6 : Section of the chat involving Re@ge” participants

Among the typical aspects of a chat, the Chat tool available at Re@ge allowed registered users to access the entire conversation held in a specific time period. This resource enabled users who did not participate in the session to retrieve the messages and even take part in the dialog by adding their own comments. Therefore, a continuous dynamic of message exchanges turned the Chat tool into a synchronous and asynchronous discussion forum.

The group started editing the content in a collaborative manner with the purpose of meeting the need that were originally identified, using the material collected during the “Daily Life Logs” activity and the discussions held on the virtual network.

They received personal assistance in using *Wiki* resources and to write texts. The collaborative document that was created turned out to be more than a mere compilation of what each participant regarded as important for the development of the topic. Debates were often held over the content and the photos submitted. Each comment posted by other participants was carefully assessed and

the final version was posted only after everybody's approval. Figure 7 presents the *Wiki* document with the content as text and photos, showing the collaborative construction of the Family Healthcare program profile in the city of Pedreira.



**Figure 7:** Interface of the *Wiki* tool on Re@ge – collaborative construction of text and photos – Profile of the Family Healthcare Program team

This interaction resulted in the printed “Re@ge Orient@” newsletter, shown in Figure 8, which was jointly created by the participants based on a collection of images, texts and group discussions.



**Figure 8:** Initial page of the printed newsletter *Re@ge Orient@*

At first it was established that the newsletter would be in printed format so that it could reach the other people in the community (families who participated in the Family Healthcare program and people who used the primary healthcare unit services) that did not have access to other media. After we funds to print these materials are obtained, they will be distributed in primary healthcare units and in public agencies in the municipality. Its content will be later revisited and posted virtually on “Vila na rede” the Digital Inclusion channel, in order to benefit not only Telecenter users but also other audiences who visit the network on the Web.

## 2. Multimedia Forum Action

This virtual community of agents was planned to be set up to provide for a number of different forms of expression, in addition to text and image (photo) with the purpose of observing the peculiarities of each participant and of the group as a whole. In this first stage, in order to address these aspects, participants relied on the asynchronous features of the *Multimedia Forum* on Re@ge website, as shown in Figure 9.



**Figure 9:** Tests performed using the *Multimedia Forum* tool Re@ge website – Tidia-Ae-Sakai

The tool meets the expectations related to the possibility of offering asynchronous audio and video interactions.

The *Topic>Reply* dynamics can be typically observed in the *Discussion Forums* in other distance learning environments. Nevertheless, it is innovative because it offers the possibility of recording/listening to audio and/or video messages in the tool using its own peripherals: microphone/headphones and the Webcam. For the relevant target audience, these features add high value because they offer the possibility of establishing digital communication using voice and image, not only text.

A face-to-face group meeting was scheduled to use the Multimedia Forum resources, as shown in Figure 10.



**Figure 10:** Re@ge participants using *Multimedia Forum* resources

One of the physicians, who is a virtual network partner, prepared a brief presentation on how he could remotely assist in the development of the activities conducted on Re@ge. The proposal of an asynchronous meeting involving the other participants also was intended to enhance the sense of “belonging” to the network and to link the audiovisual presentation to the contribution made by each individual for the virtual construction of the environment.

Most presentations were prepared in a video format using a Webcam, while some participants relied exclusively on audio resources using the microphone. Speaking in front of the camera to an unknown audience was much more difficult than any other technological hurdle! They would rehearse out loud what they intended to say (one of the participants even drafted a small text) and recorded it over and over again until they were happy with the result. Figure 11 shows different actions performed by the participants.



**Figure 11:** Re@ge Participants at the *Multimedia Forum* - Use of photos, audio and video

## FINAL CONSIDERATIONS

Overall, this paper shows the contribution of hypermedia resources to situations in which users start to actively participate in the process of discussion, preparation and production of content. Thus, it focuses on the analysis of situations which involved the use of such resources in a Digital

Inclusion context to discuss the methodological strategies that helped users master ICT skills in a critical and creative manner. As well, it identified interactions, various forms of expression, production, communication and sharing of the content produced on the network and as a network.

In this regard, we realized that the available resources can favor Digital Inclusion because they offer participants the possibility of overcoming the difficulty of expressing themselves through written texts, thus allowing their experiences to be reported, discussed and shared on the network. It is also possible to identify actions and interests that arise from the participants' interactions and exchanges, and to establish means and solutions to make these activities possible. In other words, it allows the possibility of "giving voice" and "listening" to participants instead of imposing activities which have been previously defined. Not only these, but also other strategies that favor "giving voice" and boosting the learning ability through the use of several types of media, add high value to the teaching/learning process.

The use of hypermedia resources in this Digital Inclusion context also comprises the discussion and understanding of the processes associated with ICT democratization. Allowing this group to master these resources means a qualitative leap towards the actual possibilities of them being part of the computer network. Another innovative aspect is the possibility of encouraging the creative mastery of resources so as to acquire, select, and organize information and manage knowledge. Ultimately, it allows an active participation in the network society, favoring the establishing of a social network of information and communication with other peers and with experts from different fields, and allows them to keep exchanging ideas even after the "training" or other specific actions of continuing education are completed.

Finally, the resources which are made available enable the creation of content by the participants of the Virtual Community of Learning, once they master different ICT skills to generate information in the form of photos, videos and even texts which are available in a number of different media. This content is used in different contexts and is significantly relevant from the educational, communicational and social perspectives.

The current stage of research provides evidence that the methods and the types of approach adopted have been useful both to qualify and to boost the self-esteem of the stakeholders. Based on such experience, participants can correct mistakes, define the type of action and feel sufficiently proficient to understand and develop multimedia materials that contribute to the improvement of team work, to the promotion of health and education and, as a result, to the quality of life of the community.

Therefore we believe that the pilot experience realized by Re@ge could be applied in other areas such as culture, education, and leisure, and could be rolled out to include other municipalities. In the future, based on the strategies and methods which have been consolidated, other actions can be deployed and developed to further expand the hypermedia construction of the network knowledge. The second stage of this initiative will have the current participants - who are the early participants of Re@ge - expand the network so as to reach other users of sites which provide public access to ICTs, according to the needs and interests which will surface out of these future contacts.

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<sup>[1]</sup> In Brazil, a community health agent is a lay health care worker who is not certified to practice medicine or nursing, but has the primary task of gathering information on the health status of a small community by means of a close relationship with it.

<sup>[2]</sup> Original text: “Isto significa que as tecnologias da informação e da comunicação se transformaram em elemento constituinte (e até instituinte) das nossas formas de ver e organizar o mundo... O que há de novo e inédito com as tecnologias da informação e da comunicação é a parceria cognitiva que elas estão começando a exercer na relação que o aprendente estabelece com elas.” (Assmann, 2000, p.15).

<sup>[3]</sup> In this context, “learning” refers to the characteristics of non-formal education, that is, it is part of the daily lives of the stakeholders and takes place through actions that reach beyond the traditional educational models.

<sup>[4]</sup> <http://reagindo.ning.com>

<sup>[5]</sup> The GESAC Program (GESAC stands for “Electronic Government – Federal Government Citizen Service”) was created to provide Internet access and other digital inclusion-related services to the communities deprived of access and services connected to the World Wide Web. <http://www.idbrasil.gov.br/>

[6] Infovia – LarCom Project – Unicamp (State University of Campinas)

[7] “The portal *Guia das Cidades Digitais* (Guide to Digital Cities) launches the first Census of Brazilian Digital Cities with the purpose of mapping the status of the Brazilian municipalities as regards Digital City initiatives. In other words, it is intended to determine how many, which, what they are like and what is the location of the municipalities which have programs that use ICT resources to establish a digital environment to boost public management, entrepreneurship and economic development as well as the quality of the services provided to the population.” <http://www.guiadascidadesdigitais.com.br>. Accessed on February 15, 2010.

[8] The mission of Lipacs (Multidisciplinary Laboratory of Action-Research for Healthy Communities) is to provide support to the development of research projects and studies on how ICTs can contribute to the learning process and what is the impact of these technologies on society. Therefore, as part of the Tidia-Ae Project, the purpose of Lipacs is to devise tools that allow distance education actions to be targeted at non-academic communities, especially in Digital Inclusion-related contexts. <http://www.lipacs.iar.unicamp.br>

[9] The purpose of the Tidia-Ae project is to specify, design and implement a detailed set of tools that provide support to the collaborative construction of knowledge and distance learning. The environment under development is an open source software program that can be modified, combined and expanded according to the user requirements.

[10] [www.vilanarede.org.br](http://www.vilanarede.org.br)

[11] “Vila na Rede” is an inclusive social network developed as part of the Project *e-Cidadania* (e-Citizenship) in partnership with the Microsoft Research Institute and Fapesp (State of São Paulo Research Funding Foundation).

[12] PSF (Family Healthcare Program) is regarded as one of the key strategies for the reorganization of services and professional practices applied to this level of health assistance and promotion, disease prevention and rehabilitation. [http://pt.wikipedia.org/wiki/Programa\\_Sa%C3%BAde\\_da\\_Fam%C3%ADlia](http://pt.wikipedia.org/wiki/Programa_Sa%C3%BAde_da_Fam%C3%ADlia)

[13] Skype - <http://www.skype.com/intl/pt/home/>

[14] The equipment was purchased using the financial resources provided by Fapesp (State of São Paulo Research Funding Foundation) for the “DRII” doctoral Program .