# ECCA: Augmentative Communication Collaborative Environment

Andrea Guisen, Cecilia Sanz, Armando De Giusti
Instituto de Investigación en Informática LIDI. School of Computer Science.
National University of La Plata
La Plata, Argentina
{aguisen, csanz, degiusti}@lidi.info.unlp.edu.ar

***Abstract*—The research work presented in this paper belongs to the area of Computer Technology applied to Special Education. In this context, the design of a collaborative web system (ECCA) is presented. This system incorporates features to facilitate Augmentative Communication, devised as a technology aid for the development of communication competencies in students with Complex Communication Needs. Details are provided regarding previous research work carried out to better understand the needs of the target group and the decision-making process of ECCA. Finally, the conclusions and future lines of work are presented.**

***Keywords- CSCL; Special Education; Augmentative Communication; Assistive Technology***

## I. INTRODUCTION

This work is part of a research project in the area of Computer Technology applied to Special Education. The focus of the study is limited to students with Complex Communication Needs (CCN), users of Augmentative Communication.

People with Complex Communication Needs have receptive and/or expressive abilities that are not sufficient to support their daily communication needs. Many of them use the so called AAC (Alternative and Augmentative Communication). AAC is an established set of non-verbal codes (linguistic and non-linguistic) that replace traditional communication practices when these alone are not enough to engage in effective communication with the environment.

AACS (Alternative and Augmentative Communication Systems) are the tools used for teaching and using AAC, and they allow putting communication methods into practice. They are classified into "unattended" (they do not require the use of any external device, other than one's own body) and "attended" (they require the use of an external device of low, medium, or high technological level that acts as system support) [1] [2] [3].

High technology Alternative and Augmentative Systems (HT AACS) are software applications designed to carry out AAC tasks through the use of graphic signs. The emergence of computers that are increasingly cheap, portable, and with long battery life allows their transportation and use, resulting in an improved socialization of the user in various social environments. The possibilities offered by the advance of computer technology results in a growing use of these devices.

For these social actors, ICTs become a means, a "communicational prosthesis" that allows the development and optimization of their communicational competencies, and at the same time enables an efficient and effective dialogue with the environment, creating the necessary conditions to experience the educational process and, oftentimes, to be later on integrated to the regular school.

The research work presented here is in line with the set of scientific productions oriented towards the development of technologies for the integration of diversity into the educational environment. The training in AAC practices by means of computer technology, through activities that are relevant for the teaching and learning methodology used in this scenario, is part of the set of strategies that, through complementation, could offer optimal results for students who are users of AAC, to develop the communicational competencies required for their incorporation to a high-technology AACS. In this sense, it is considered that an AAC collaborative system is a tool that could support the practices described here.

This hypothesis is based on the fact that collaboration, through dialogue and conversation, is an interaction dynamics suitable for the teaching and learning methodology used in this educational scenario that assumes the active participation of group members by means of effective communication techniques. By exercising AAC, students learn by doing, incorporating practical knowledge to their cognitive scheme and generating the effective mobilization of communication competence through the inter-subject experience of collaboration. This type of tools also enables socialization beyond the attendance of the individual to an educational facility. Thus, the design of the ECCA (Augmentative Communication Collaborative Environment) begins as a result of a research process in these fields.

It is included in the set of technologies known as "Assistive Technology" [4].

In Section II, research phases are presented. Then, the main design decisions made for ECCA and their rationale are discussed. Finally, some implementation details are described, followed by the conclusions and future lines of work.

## II. Research Methodology

This is an ethnographic research work aimed at capturing, as information source, the viewpoint of the social actors that are affected by this situation. During the first stages, bibliography analysis is more intense, but emphasis is transferred to field work at later stages. The methodology analyzed is of a qualitative and quantitative nature; which means that a strategic combination of information recording, collection and processing techniques is involved.

Field work was organized in 3 phases. The first stage involved the observation and participation in collaborative group, dynamics in groups of students who are users of high- and low-technology AACS. The purpose of this stage was to identify interaction processes, the role of the teacher, and communication demands evident from the possibilities and limitations of the technology being used. An observer-participant attended to sessions at AEDIN (Association for the Defense of the Neurologic Infant) and VITRA (Housing, Work, and Training for the Disabled Foundation). Both institutions are in the Autonomous City of Buenos Aires, and their work is oriented to therapeutic educational work with students with neuromotor disorder. Most of these students are users or potential users of AAC.

During the second phase of the research, participating social actors were identified, and issues of interest were selected to be discussed in detail in open interviews with them. The social actors identified were: special education teacher of students who are users of AACS; speech therapist specialized in AAC; ICTs and AAC specialists, academic and/or researchers, from the Computer Science and Educational Sciences fields; if possible, HT AACS user and user family. For each social actor, 2 or 3 key informers were selected. The format of the interviews evolved from unstructured interviews to semi-structured, to structured.

During the first steps of the research, criteria and indicators were defined (they were later on reformulated based on the results obtained from the interviews), in order to be able to analyze collaborative systems that are based on web technologies and AAC software; these were selected following the opinion of experts in the area. This was the starting point for the design of ECCA, and allowed defining its functional and interaction requirements.

With the technical specification of requirements, the first prototype of the system was built. The third phase of field work will consist in testing the prototype. Currently, the research project is at this stage.

In the following section, the results obtained during the first phase of field work are described.

## III. First Research Result

The first phase of the research project yielded several results. Firstly, it was observed that there is a tendency towards the use of high-technology AACS due to the advantages they offer. The use of a high-technology AACS that allows seamless communication between the user and his or her environment is currently considered to be the ultimate goal of the training process for AAC.

On the other hand, language and AAC teaching development phases articulate with those of the incorporation of a high-technology AACS; and the entire process takes place in the classroom where a number of aspects constituting the teaching and learning methodology specific to this educational scenario are established. In this sense, the basic features of the teaching and learning methodology used in the classroom with CCN students who use AAC were identified:

- Groups are small (5 students/group approximately), and students are grouped by level based on the assessment of their competencies.
- The prevalent work methodologies used in the classroom are collaborative group dynamics. In this context, the teacher acts as mediator or facilitator.
- Even though work is done in groups, teaching is personalized. Time is not standardized (there is no mandatory standard). The individual process required by each student to acquire knowledge is respected.
- As regards contents, these are the same as in regular education, but the curriculum is adapted. Knowledge is built in an integrated manner, and it is inserted in the current cultural context of the students. The starting point is the previous knowledge, and upon that, new knowledge is built. Students learn by doing. And as they experience, they discover.
- The concepts of communication and autonomy are key in this educational environment. Work on these aspects is done while working on curricular contents.

Only some of the observations made are mentioned here. Based on the advances with experts in the area, system requirements were defined for ECCA. It includes a number of tools that can support collaborative activities, where users participate through didactic text messages written in AAC language. At this stage, based on the results of the first and second research phases, a series of essential features were defined for the application to be developed. They are presented in the following section.

## IV. ECCA Design Decisions

In this section, the main decisions made regarding ECCA are described. These decisions were based on the previous research phases.

While the system is designed as an educational software application for developing collaborative activities that allow learning AAC practices, its functional design will allow expanding its use both in this context as well as in general socialization, by integrating the functions of a medium-technology portable communicator, on-line socialization, and educational environment.

The system can be run both offline and online. Users can download it from the Web or use it directly through their Web browsers. Thus, they can work with their word processor and

dashboard editor offline, save what they did, and then upload it when they have an Internet connection available.

The interface must be icon-based, i.e., visual. This means that icons are used for interaction and visual representation [5]. In this case, the AAC language used as reference to create the icons is "ARASAAC". ARASAAC pictograms were created in Spain by the Aragon Center for Education Technologies (CATEDU), professionals from the Alborada Special Education Public School, and graphic designer Sergio Palao in 2008 under the Creative Commons license [6]. Although nowadays there is a number of pictographic languages, such as the Pictographic Communication System (PCS) and Bliss [7], we have chosen ARASAAC to be used for the proposed environment because of its widespread use (it is free, has an optimal design, and includes a wide variety of pictograms). Until the appearance of ARASAAC, PCS was the AAC language that was most widely used globally in educational and therapeutic institutions.

To create the environment, only those tools that involve using text for the act of participation will be used: dashboard editor and AAC text processor, tools for creating didactic messages, work groups, user profiles, wall, messaging, virtual meetings (chat and virtual conferences), collaborative conceptual map, and asynchronous discussion. Tools were selected based on the input from experts in computer technology applied to AAC, during the second phase of the field work.

On the other hand, ECCA has the features of ubiquity and invisibility. Ubiquity, because it is designed to be used both in portable devices (oftentimes anchored to a wheelchair) and desktop computers, in such a manner that it accompanies users in any social space. Additionally, its "multiplatform" feature will allow installing the system in different types of devices regardless of their operating system. In this sense, the goal is that the device is "unnoticed" in the physical medium. In addition to that, as Donald Norman puts it, technology must be behind, not before, the tasks; it must reduce the space between device and user, incorporating its functions in a natural manner to achieve a "feeling of invisibility" [8].

ECCA offers a configurable interface that allows adapting the system to the specific needs of each user. To achieve this, adaptation signs are projected grouped in patterns based on the aspect being adapted:

- Pattern of preferences: interface look and feel. Functions that model visual aspects.
- Pattern of knowledge: information represented on the interface. Functions that model the contents presented.
- Pattern of behavior: interface behavior. Functions that model use based on user habits.

ECCA is designed taking into account the need for co-operation with digital ramps and adaptations. This is a highly important feature, since every user is different and unique and, even though the design of ECCA tries to offer all needed functionalities, it is understood that it may be necessary to combine it with other specific software applications.

The design and development of a number of tools is proposed in ECCA, but the possibility of adding new functions in the future is also present. Thus, the feature of scalability allows for a possible extension.

As system oriented to user collaboration, it must offer features to coordinate groups. In this regard, when assessing the tools that could be added to the environment, the following criteria were used as parameters: degree of interaction among the users of the environment, interaction time in the selected collaborative tools (synchronous, asynchronous), and the functionality of awareness (this is what allows the user to be aware of the interaction of the other users with the system).

As regards the tools that are part of the collaborative system, the following list shows the ones that were selected, based on feedback collected from experts [9], together with some specific applications that implement them and were taken as examples:

*a. Development of conceptual maps*. Applications such as Inspiration, CmapTools, and FreeMind were studied.

*b. Virtual meetings*. Lotus Time, Messenger Visual, Saba Centra, and Skype were analyzed as examples.

*c. Asynchronous discussion.* The tool incorporated in Moodle for forums and that from E-ducativa were studied and resulted of interest.

*d. Asynchronous messaging.* Gmail and the tool from EVEA E-ducativa were studied.

*e. Creation and repository of shared documents.* Google docs and the tool from EVEA WebUnlp were studied.

As tool for the creation of the didactic messages, an AAC text processor and a communication dashboard editor were also analyzed and developed. To this end, applications such as AraWord and Plaphoons were studied. In addition to that, other related applications and projects were analyzed: Sc@ut (Adaptative and Augmentative Communication System), Visual Messenger (a chat based on pictograms) and Azahar – Hola (an application for mobile devices based on pictograms).

All interviewees expressed that it is important that the environment operates as social networks do, regarding its potential to ultimately be used as a socialization tool. Since this idea was unanimous, its causes and rationale were analyzed to determine which aspects of social networks the environment should have, and what specific tools can be used to achieve this. As a result, the following tools were selected to be part of the environment: user profile, work group, and wall (the possibilities offered by Facebook and Ning were studied).

On the other hand, it was observed that AACS software applications basically include two roles: teacher user and student user. Other, optional users are administrator and guest. Additionally, depending on the task, the teacher can assign certain specific permissions and restrictions to the student. ECCA provides three user profiles: Friend Role (end user), Teacher Role (administrator), and Facilitator Role (user with configuration rights). Each of these roles involves permissions and restrictions regarding system use.

## V. IMPLEMENTATION OF ECCA

An evolutionary prototype of ECCA is currently being developed.

It is based on the ELGG environment, which is open source. This environment allows developing social networks from a set of tools such as wall, file repository, and messaging, among others [10]. The starting point is then a scalable and customizable environment that is being redesigned to meet the requirements established for ECCA.

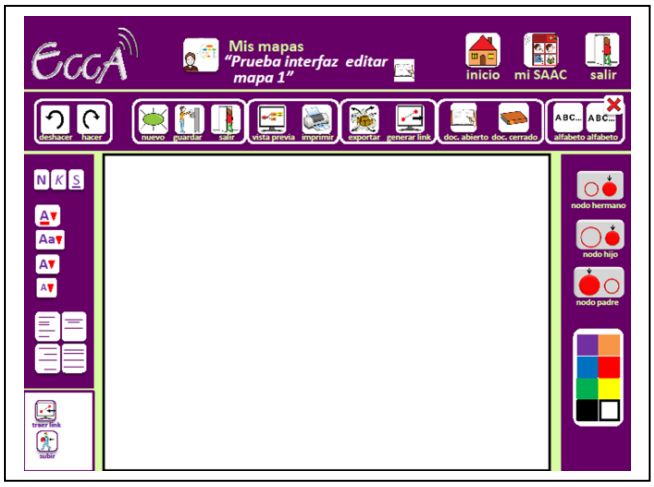


Figure 1. Example of ECCA Collaborative Conceptual Map Tool.

The environment has been provided with a dashboard editor and a word processor that are based on pictograms. The first prototype has the functionality of some of the tools planned, integrating the creation of didactic messages through the word processor for AAC. Thus, a first test run of ECCA is being planned with field experts who can provide their feedback and help establish the baseline for the next evolutionary stage.

## VI. CONCLUSIONS AND FUTURE WORK

In the context of the research work done, we consider that a collaborative AAC Web system is appropriate for developing the communicational competencies of students who are learning an AT AACS. The communicational potential of these systems combined with AT AACS should be analyzed in order to create a methodological proposal that defines the features that alternative augmentative communication collaborative systems should offer. Additionally, an evolutionary prototype, called ECCA, is being developed based on the results of the research work. Partial tests are planned as part of the evolutionary process, aimed at improving the development of the application with the feedback collected from field experts. ECCA is considered to be a contribution to the ICTs and Special Education areas.

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