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Collaborative Composition in a Foreign Language with Handheld Computing and Web Tools

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Abstract: Writing applications are currently designed for desktop personal computers. Mobile devices like PDAs or smart phones are increasingly being used for mobile applications such as access to information sources or local work on the device, but they are seldom used for collaborative tasks. Here we present AULA and AWLA, two applications that put mobile devices and collaborative educational environments together inside and outside the classroom. They are designed under the paradigm of collaborative composition writing in language learning courses, in particular English as a Foreign Language (EFL).

Keywords: Collaborative learning, Mobile computing, Pervasive computing, Synchronous interaction
Categories: H.5.2, H.5.3, K.3.1

1 Introduction

In the last decades the tendency to apply Computer-Assisted Language Learning (CALL) has focused on adapting language learning activities to the computer [Chapelle 1994]. CALL has contributed with providing greater access to information. The main functionality of CALL has been to deliver a large amount of content, first in CD-ROMs, and now accessible on the Web.

For that purpose, CALL classrooms were filled up with desktop PCs. Printed materials became digitised, but those drill and practice materials were still based upon repetition techniques and content delivery purposes. Its use mainly focused on exam-based activities. The students only interact with the computer. There is no

communication in writing and speaking in the classroom in real time, and students work in isolation, focusing their attention onto the computer screen. The integration of computers in the traditional classroom has been difficult. The computing components used in the classroom (mainly Desktop PCs) seem to hinder the learning activity. The separation of these two worlds is critical: the computer and the rest of the classroom [Ortega 2001].

A more integrated environment is required where the students can interact whether in the classroom or outside the classroom. They will be able to access information, which they can share, and communicate synchronously or asynchronously by writing from anywhere and speaking face to face when they are in the classroom where they will address their attention from time to time to the teacher and to the blackboard. The classroom should then be enhanced with technological devices, providing the traditional elements (the blackboard, the notebooks) with computing capacities [Ortega 2001]. It is the Ubiquitous TELL Classroom. This study proposes TELL (Technology-Enhanced Language Learning) as an e-learning environment enhancing language communication and, hence, language learning. With TELL, the e-learning environment is not just a system providing content (learning objects) but a real mechanism which enables the use of language and ICT tools to communicate and have access to information, meeting the new needs and possibilities of the Information Society.

TELL environments are not an essential element to support the learning activity themselves [Warschauer 1997] as CALL environments are where computers technologically support the language learning process, but TELL improves learning by providing further capabilities. Since there is a tradition in the learning mechanism based on the traditional classroom with a teacher, a blackboard, books, pen and paper, TELL allows adapting the traditional classroom without apparently much change, thus making the traditional learning advantages coexist with more innovative improvements.

Our objectives have been the following:

1. Integration of technological paradigms such as ubiquitous computing and wireless networked technologies for language learning to favour the textual exchange of information anywhere at any time establishing the basis for blended learning environments.
2. Developing techniques for designing collaborative environments online with the features of usability, portability, adaptability and monitorization.
3. Implantation of new environments of interaction which offers the opportunity to design the learning materials and tasks.
4. Integration of linguistic and computing resources within learning environments.

Currently, mobile devices integrated in the classroom are becoming quite usual. ICT provide educational environments with the capacity to be also applied at a distance, simultaneously or asynchronously, in the same place or in ubiquitous environments, and individually or in collaboration.

A technology-enhanced infrastructure has, then, been established to enable writing in ubiquitous and collaborative online environments. For this purpose, a series of computing tools give support to the group work, taking into account the benefits provided by the new paradigm of human-computer interaction in ubiquitous

environments. The enhancements proposed here consist in the deployment of the ubiquitous paradigm. The emergence of "ubiquitous computing" [Weiser 1991] with small computational devices, wirelessly interconnected and connected to the Internet, working as electronic notebooks and interactive whiteboards, will finally enable the technologically enhanced classroom by making the computer 'disappear', unnoticeably pervading in the learning environment. The paradigm of ubiquitous computing allows us to break down the borderline fading the computational environment into the classroom. In this way, the students are in their natural scenario where they interact: a classroom with classmates, the whiteboard and the teacher. An improved scenario has been proposed: the real classroom enhanced with the use of the latest writing tool (computing devices as notebooks), with access to a common source of information (an intranet or the Internet), and at the same time with authentic communication tools (chat facilities and email services) [Ortega 2004].

2 Collaborative environments and applications

There are a great number of CSCL applications (Computer Supported Collaborative Learning), many of which are based on personal desktop computers. Unfortunately these applications are not directly transferable to mobile computing systems. If we try to compile the source code of these applications directly into a mobile device such as a PDA (Personal Digital Assistant) and to execute it, we can notice that it would fail due to device and network characteristics [Roth 2000]. Obviously, characteristics such as the computing power and memory capacity, the services provided by the operating system, or simply the size of the screen are very different in a handheld device or a cellular telephone from those offered by a personal computer. These characteristics must be taken into account when we implement an application. Therefore we need new CSCL applications for mobile computing environments.

Additionally, when dealing with collaboration a new aspect comes into consideration: the use of networks and the emergence of new environments. In this sense, new factors come into play: intranet networks and the use of the Internet.

Our group is carrying out several projects focused on the exploration and search for new interactive educational technologies based on ubiquitous computing implemented both in hardware and in software into new networked communities of learning. Our ultimate goal is aimed at providing computer support of education in a non invasive way. This aim must consider that the student should not be aware of invasive issues such as the existence of cables or having to line up their devices to establish communication. In addition, it should satisfy a number of requirements which are becoming common in formal education: supporting collaborative tasks, supporting learning tasks before, during and after the class, and providing synchronous and asynchronous interaction.

Currently, ubiquitous systems applied in the learning environment are scarce and provide little support for collaborative work. Existing applications satisfy some requirements of the scenario under consideration, but not all. The system described by Roth and Unger [Roth 2000] is a robust system that supports collaborative and information management tasks in a ubiquitous environment, but it lacks support for context information. The system of annotation and documentation suggested by Baldonado et al. [Baldonado 2000] supports documents manipulation by a group of

users. However this system is not appropriate for a permanently collaborative learning scenario since communication among the members is sporadic, without the permanent synchronization required for group discussion. Zurita and Nussbaum [Zurita 2003] solve the inconveniences of infrared networks using a wireless network. In their proposal the students have to collaboratively form words from syllables that are viewed in their PDAs, accepting some and rejecting others. However, their collaborative tools do not support proposal discussion. *Classroom 2000* [Abowd 1999] is a ubiquitous system intended to be a useful aid after the class but our requirements consider the whole learning process: before, during and after the class. PiCoMap™ [Solloway 2001] allows students to share concept maps on their handheld. This program allows users to create multiple nodes and relationships leading to elaborate concept maps for brainstorming, visual outlining or assessment purposes. This system provides good scaffolding methods but it does not allow directing the students' activity or setting in group the students' proposals.

Some collaborative editing systems have been developed, though they are usually complex and lack the flexibility, the pedagogical objective and the full ubiquitous capacity that the resulting applications derived from this research aims to offer. Other learning environments based on the Internet are more common. The emergence of Learning Management Systems (LMS) provides support for large communities of learning giving access to information and learning objects to group of learners and enable their management from the tutors and educational technologists. However, the collaborative support is limited to communication through the chat and email exchange of messages, but LMS do not offer collaborative support for collaborative edition directly. More interactive learning environments have emerged such as Communities of Practice or Learning Communities [Wenger 1998; Jonassen 1999; Kaplan 2002], whose participants share the same interests and goals for learning. The most outstanding feature of these communities is that they provide participants with the communication facilities mentioned, chats and email, together with other more emerging interactive Web technologies for collaboration such as the Wiki technology [Leuf 2001] and Blogging environments. Other works have focused on extensive user groups. Sumi and Mase [Sumi 2001] developed services based on mobile, ubiquitous and web technologies for participants (with a PDA) in an academic conference. This system efficiently enriched the relationships among participants. We focus on smaller user groups.

Some communities and educational institutions use commercial collaborative editing tools which run on vendor-specific applications such as Microsoft NetMeeting, Microsoft SharePoint, Google Docs, Moodle and the like, but they do not have a pedagogical design, nor are they designed specifically for mobile computing. Providing them with pedagogical background will enable the application of ubiquitous web-based collaboration for editing and learning how to write.

In this paper we present AULA and AWLA. AULA (A Ubiquitous Language Appliance), a platform of ubiquitous computation based on mobile devices for the teaching of natural languages, in particular English as a Foreign Language (EFL). AWLA (A Writing eLearning Appliance) is a similar application implemented on the Web. We conceive the set of tools for document composition as an agent-like service for the students to edit texts in collaboration with ubiquitous devices using tasks and activities designed by the tutor, who guides them in the writing process.

3 Collaborative Tools for the Writing Process

The AULA platform is intended to support collaboration in a learning environment where groups are assigned the task of writing a text in a foreign language [Paredes 2003]. The AULA platform is composed of: a two-way projection/edition whiteboard, a database server, the *Location Manager* (providing context-aware to the system), the *Session Coordinator* and the mobile devices (PDAs and possibly Tablet PCs). Each student has his/her own mobile device. The communication technologies used are: a wireless network (RF) and infrared communications. As it is usual in foreign language courses, the platform assumes that a class consists of a unique group formed by a small number of students.

3.1 Composition Assignment

When the class starts, the teacher indicates the topic of the document and other characteristics or properties that s/he considers relevant to the students. The teacher can make these suggestions in several ways: verbally, using synchronous and asynchronous collaborative tools that are provided by AULA or combining both possibilities.

The system AULA assists the teacher in assigning a role to each student in the composition project by providing a students' profile. This profile is created by AULA and the teacher thanks to a process of synthesis and conclusion, which analyzes the students' information recorded in previous compositions. The system identifies two possible roles into the composition process:

- Creative: the student generates base ideas for the document.
- Manager: the student organizes the presentation of the ideas.

3.2 Composition Tools

After this first phase, a brainstorming session about the composition subject starts, in which the group members discuss which contents are most appropriate to be included into the written composition. The AULA system provides the student with several tools to collaboratively write a text in English in a ubiquitous environment. The students access these tools through their PDAs. There are two types of tools: (synchronous and asynchronous) collaborative communication tools, and language tools.

The most important tool is a collaborative application that facilitates the discussion and composition of the initial framework of the document. The composition has a title and consists of two levels of blocks of partial information, called "aspects" and "ideas". [Fig. 1] shows the application user interface of a mobile device during the composition process of a document. We can see three well defined working areas: the *Individual Edition* workspace (in which each student will write his/her individual contribution), the *Collaborative Visualization* workspace (where all the contributions of the group are displayed) and the *Final Document Edition* workspace (it shows the proposals that have been accepted and will form the document). The figure also shows two typical actions on two different frames: to insert a new idea within an aspect (top), and to vote an aspect proposal (bottom).

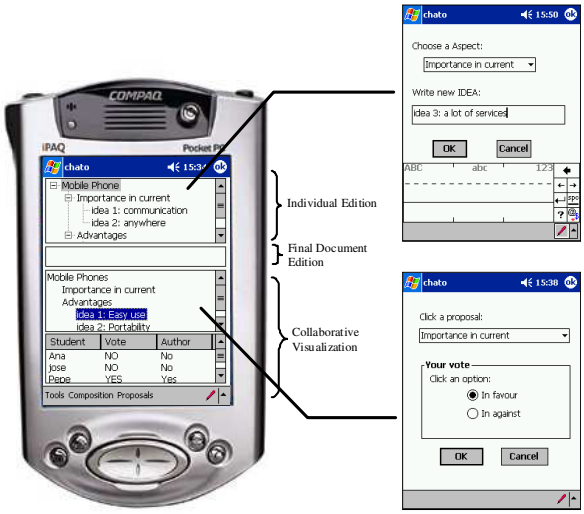

Figure 1: The application in a mobile device during a composition writing activity

Another synchronous collaborative tool is a chat channel, through which all the members of the group and the teacher can talk simultaneously. The student uses this tool to make online requests for information to the teacher or to other colleagues, although the main utility of this tool is to support the debate about the proposals which is held previous to the vote. The asynchronous collaborative tool provided by the system is an email facility. The email facility structures all the information into aspects and ideas [see Fig. 2 and 3]. The mailboxes (Inbox and Sent) are organized according to such aspects and ideas. Every time a student suggests a new aspect or idea to the group, this framewo rk updates, being a copy of the Collaborative Visualization space. All the mails are related to an idea or aspect via the subject line (which explicitly refers to them).

Figure 2: Electronic mail tool

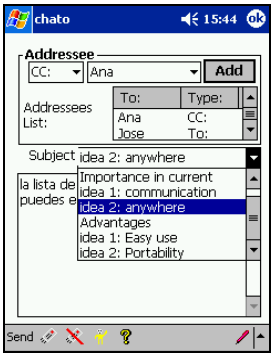

Figure 3: Answering a message

Throughout this process, the teacher is present and plays a monitoring role. The teacher can give brief suggestions or clarifications about some proposals, which would be projected on the whiteboard. However, the students play the role of project manager. The process of discussion finishes when the students in a group get to an agreement, accepting some aspects and ideas suggested and refusing others, through the polling process provided by the system.

It is unrealistic to consider that the group members will be able to finish their work in one session. It is an innovative feature in teaching with ubiquitous computing that the student may prepare a part of the work at home and on the following day discusses it in group with the rest of the members of the class. The system facilitates the accomplishment of this task in the following way: when the student enters into the classroom, automatically the system sends his work to the teacher's computer and to the other group members' PDAs. A synchronization process updates the information automatically. These mechanisms make the AULA system unique and different from other learning systems, as it provides support to the student before, during and after the class.

Once these partial components of the document have been built, the students focus on rewriting them by adding correct syntactic elements, delivering a complete text. Now the student could need linguistic tools. AULA provides the student with three language tools, accessed by the student's PDA: dictionaries (monolingual as well as bilingual), an electronic grammar book and a case library. Therefore, the students do not have to leave their working area. This way they keep concentrated in their task. Later, the text is proposed for revision and acceptance to the members of the group. Once this has been carried out, the teacher revises the document and explains possible mistakes. Then, the document is saved in a case database. Finally the teacher makes an evaluation to every student with the aid of synthesis process tools, which show conclusions about the working process and the learners' solution.

3.3 Teacher's Tools

We have mentioned some tools which are useful both for the students and the teacher. The AULA system also offers some tools specifically designed for the teacher and accessible through a desktop PC or PDA. These tools assist the teacher in several tasks: defining parameters about the type of composition, carrying out a follow-up study of the construction process, and evaluating the students and the group. The first tool allows defining some parameters such as the topic of the composition or the time available to make it. The second tool allows monitoring traces of the students' actions. The third tool is the most complex and requires a more elaborate explanation.

Typically, the teacher evaluates the group activity by marking two aspects: the quality of the delivered document and every student's performance during the project, which must mainly rely on the teacher's memory and his/her ability to infer about it. The latter aspect is hard for the teacher, especially due to emotional implication. Obviously, the teacher wonders about questions such as: Who has suggested this particular idea? Has this student taken part in the process of discussion actively? To what extent? Did such a student contribute proposals with aspects and ideas to the group?

The quality of the composition is marked by the teacher and stored at the AULA system. S/he must give his/her opinion about aspects such as its grammatical accuracy or communication ability.

To solve this, the AULA system traces and records the students' actions and generates some conclusions about the working process through an inference process. In particular, the teacher is assisted to analyze questions such as: the progress of each student in language development (globally as well as in particular areas), the student's reaction to errors made by other members of the group or the historical participation of a student in previous activities. We make use of the indicators of effective collaborative learning as shown by Soller [Soller 2001]. The inference system consists in linking attributes isolated from the user with processes of action. These processes of action are blocks of information, which define communicative characteristics of the user and of the group in the activity of writing compositions [Barros 1999].

4 Students' work in AWLA

The AWLA appliance has most of the features of AULA. It lacks the awareness facility since synchronization is not necessary as it works on the Web. All the students work with the same document. They negotiate their participation by means of a Web-based chat tool and all their actions are traced on the server in a tracking file which the teacher analyses easily. The server works in a similar way as the Session Coordinator. Collaboration is negotiated in roles but it avoid votations, relying on natural discussion on the chat. AWLA makes use of blogging and wiki technologies to form learning communities of practice where the tutor guides the learners in an always visible task that he can adapt at runtime reacting to the evolution of the writing activity on the fly.

It follows the same writing process (brainstorming, debate and final edition) and adds the facility to integrate sound, image and video files in the text, enriching it with visual and sound context.

AWLA is being used by several groups of students from different centers and its extensive use has validated it as an effective writing tool for learning how to write by writing.

In the year 2005, its use has been in the number of participants (120 different users) and in texts (220) but also in the models (8), levels (7) and developed scenarios (7). It has been noticed as a remarkable result how easy it is to apply the system to other educational environments (monographic courses, University courses and training courses for staff development) and the possibility of its integration in online learning systems. The greatest difficulty found as to hardware has been to verify that the use of Digital Assistants (PDAs), due to their small size, causes difficulties in the text edition and, due to the operating system used, Microsoft Pocket PC 2003, it does not completely run the functionalities of common forms in JavaScript. However, the system automatically adapts when recognising the browser interface of the PDA and reorganizes the presentation of the edition areas, the display of the tasks, the menus and the action buttons in the way shown in [Fig. 4].

Scenario or Task	No. of Texts/Users	Task Model	Course-Level
SmartWear	12	Exam 12/04	4º EOI B2 Eng. Students
New Technologies	16	Collaborative	4º EOI B2 Eng. Students
Treasured Possessions	25	From Textbook	4º EOI B2 Eng. Students
BioProfiles	25	From Textbook	4º EOI B2 Eng. Students
Complaint Letters	20	Workbook	4º EOI B2 Eng. Students
Euita Research Papers	10 +10 Biodata/10	Teacher Training	EUITA Researchers
TheThirdMan	1	Exam	4º EOI B2 Eng. Students
FamilyLife	9	Exam	4º EOI B2 Eng. Students
BadExperience	11	Exam	4º EOI B2 Eng. Students
CrazyHabit	1	Exam	4º EOI B2 Eng. Students
Describing People	13	Workbook	4º & Life-long Learners
CollaborativeTexts	3/6+7+6	Collaborative	4º EOI B2 Eng. Students
Chemistry Research Papers	9+23 Biodata/9(23)	Teacher Training	Chemistry Researchers
InglesTecnico	40		University students.
WeekNews	4	WebQuest	Life-long Learners
Freizeit Hobbys	8	From Textbook	5º EOI B2 Ger. Students
(Others: testing texts: external users)	Not counted	Not counted	French, Spanish,,English
Totals: 16 + 2 Biodata	220/212 (120 diff)	8 models	7 Levels

Table 1: AWLA Usage during the year 2005

Figure 4: AWLA Interface for PDAs: homepage with tasks and edition page

In the year 2006 AWLA was integrated in the AIOLE generator of online learning environments which was used by around 600 of University students. Other assignments have followed, easily adapted from writing activities on paper in the textbooks. During the 2006-2007 academic course, it is being used by students of the

1st level and 5th level in English and students of German at the EOI Languages School, and by students of English Language at the University. There is a formal application to be used by students of Spanish at the University of Firenze, in Italy.

5 Conclusions and Future Work

In this article we have shown a model for learning that uses mobile devices as the interaction paradigm. The ultimate goal of this model is to research the implications of ubiquitous computation for collaborative learning. Our work has focused on the teaching of English as a Foreign Language through composition writing in group. The resulting system is called AULA.

In this working context, a large quantity of information is produced. The information structuring that the system makes into two levels (aspect & idea) is suitable from the pedagogical point of view (by providing a clear visual organization for the students) and facilitates the dynamics of the activity (erasing, modifying, etc). The student proposals are stored in a persistent way in his/her individual workspace allowing the student to work even when the mobile device is not connected to the system (in this case, synchronous collaboration functionalities are not accessible, but many others do).

We have been particularly concerned with the non obstructive use of the system: the student should not feel intimidated or limited. The students are more comfortable at first if they feel that they are in a traditional classroom. In our model, the students continuously take notes and write in what seem their small notebooks (PDA) and frequently direct their attention to the whiteboard, where the teacher presents the information. This way the traditional elements do not disappear, but they evolve thanks to electronic devices. In the near future we plan to analyze and compare the results of our system with the results obtained by traditional methodologies, as to their effects on the development of communication abilities in English.

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