INTERNET SUPPORT FOR COLLABORATIVE LEARNING IN WORKGROUPS

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Abstract

This paper intends to describe an ongoing experiment that provides a collaborative learning method applied to a case study in higher education.

With this purpose, a computer-based support on World Wide Web is developed, by means of which, a virtual classroom environment is provided to carry out asynchronous and distributed work. This environment facilitates a time -and -space independent communication among users in order to plan groupwork sessions; this support reduces both the assessments on the part of the teacher and classroom overcrowding problems.

In addition, two collaborative environments in the classroom are identified: the first one, among the members of a group and, the second one, among groups in the classroom.

1. Introduction

Groupwork methods have frequently been used in business environments, where they are intended to provide a support that allows persons to work together in a faster, more efficient and productive way.

The infrastructure of groupwork is articulated around the three axes showed in Figure 1 [7]:

- communication, using powerful tools for electronic mail;
- collaboration, inside a virtual work environment, that facilitates information and resource interchange and shared use;
- and coordination, that integrates communication and collaboration in a global infrastructure, providing the efficient solution of business processes.

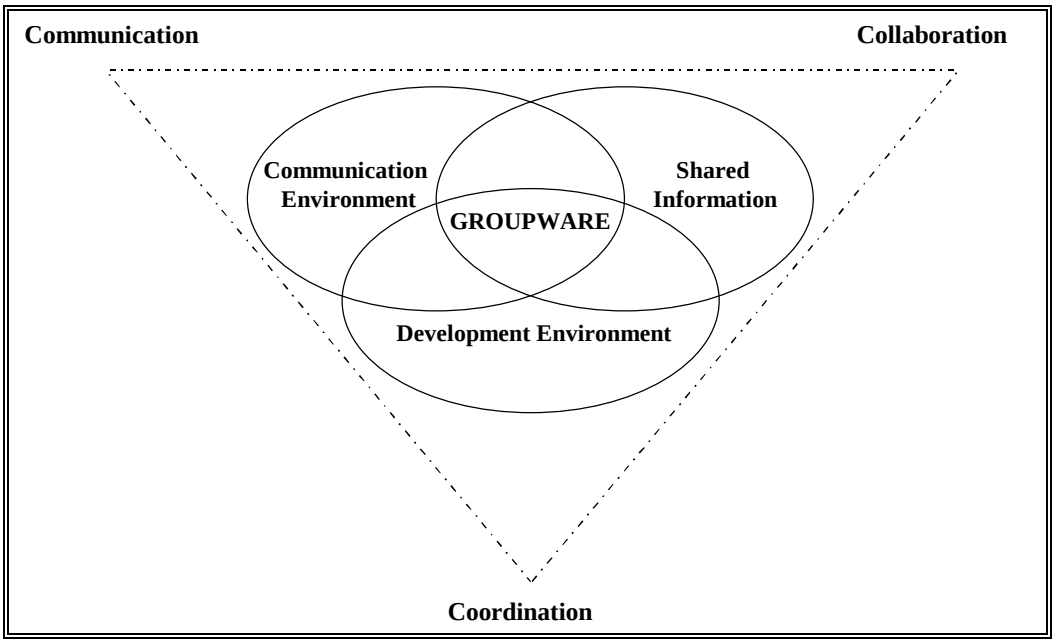

Figure 1: *Groupwork infrastructure.*

Groupware is, then, a software platform in which the transparent and efficient integration of three primary technologies is materialized:

- a dynamic object container, that allows the storing and management of business information resources (messages, documents, forms, reports, and so on…)
- an access and distribution model that supplies information location to its users for its later spreading.
- and a infrastructure for applications development in which source services for object storage and for the access and distribution model are transparently integrated and strengthened.

Due to this, educational institutions are specially interested in forming students with synthesis and decision making capacities to solve business environment problems, and therefore are teaching

learning processes as well as technical contents.

Moreover, the so called Information Society is constituted by the technological development of communication networks and current mass media, by means of which it is possible to facilitate distance learning, diversifying the educational offer. According to the European Commission for the Information Society Forum: „The Information Society must become the "Lifelong Learning Society" which means that the sources of education and training must be extended beyond the traditional institutions to include the home, the community, companies and other organisations“ [6].

Collaborative learning in workgroups and case-based learning, are nowadays two pedagogical methods in the educational environment. The purpose of the former is to promote learning by means of active communication among members in a workgroup, while the latter tries to fix ideas and concepts that facilitate learning through real world problem solving [4].

Both kinds of learning are applied to university technical distance learning. In many educational establishments, students in classrooms are too numerous and not very homogeneous with regard to the subjects they study. Consequently, there are classroom overcrowding and coordination problems when programming the place and time for work sessions. An added obstacle is the teacher’s difficulties to assess the individual work of each student in a group [9].

An alternative way to traditional learning is making use of Internet support and its associated services. The use of this technology brings about a time-and-space independent communication among several people, and includes the teacher as an observer that can assess and monitor the progress in students’ work.

This alternative path can become extremely useful as a support for collaborative learning in standard courses; however, it is in distance courses where it mainly shows its usefulness, since in these ones, frequent meeting of group members is more difficult.

The aim of this paper is to facilitate both kinds of learning, providing a computer-based support to carry out spatial but also temporal distance groupwork. Besides, this computer based support facilitates the teacher’s assessment and supervision of students’ work.

2. Collaborative learning in workgroups

According to Johnson and Johnson, when developing a computer support to provide collaborative learning in workgroups, the following components should be considered [8]:

- Positive interdependence among students who learn and help each other to learn.

- Face-to-face promotive action by means of which students help each other through problems, offer feedback to each other, and encourage others to participate.

- Individual accountability and personal responsibility. Each student's work is assessed, especially regarding its contribution to the group's work.

- Interpersonal and small group skills, through which students build a solution together, communicate their knowledge and feelings, accept and support each other, and solve conflicts in a constructive way.

- Group processing in which the group discusses how to work together effectively.

In our system, a case study was proposed to the pupils, in which a software problem about object oriented programming was to be solved by twenty pupils in groups of five persons.

The collaborative learning structure that has been adopted to design the support is shown in Figure 2, where interaction among group members to achieve a consensus in their solution, and groups interaction to contrast their different solutions can be seen. The teacher works as an observer and adviser in pupils' learning progress.

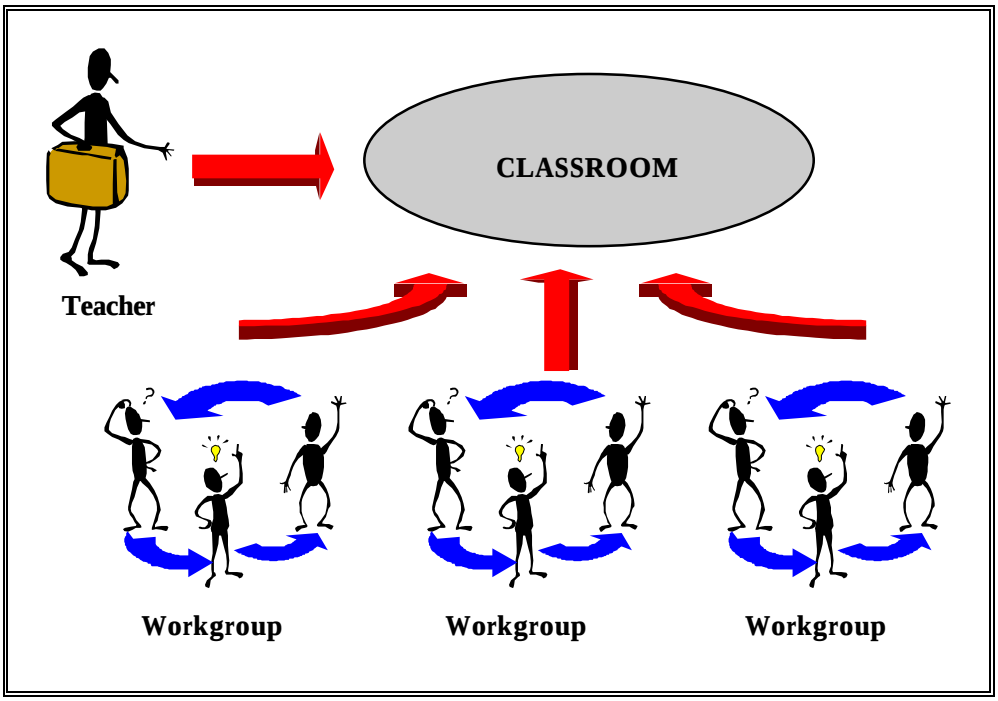

Figure 2: *Collaborative learning.*

2.1 Collaborative environment characteristics

When a classroom is divided up into several groups, two environments for collaboration can appear: one, among the members of a workgroup, and the other one, among the different groups in a classroom.

2.1.1 Collaborative environment in workgroups

The common goal for the members of a workgroup is to reach a solution for the case study proposed by the teacher. This solution must be reached by consensus, so there should exist a strong cohesion in the team and fluent communication among members in the group.

The number of members in each group can vary depending on the problem to solve: Aguilar et al. advise a size in the interval [7±2] to foster integration and participation of every member [1], however, our experiments have obtained better results using the interval [5±1].

2.1.2 Collaborative environment in the classroom

The classroom collaborative environment is generated when groups exchange and compare ideas, solutions, criteria, and so on… This produces a strong interaction among groups that, on the one hand, review and discuss the solution which is put forward, and besides, extract new conclusions and ideas that each group will be able to apply to their own solution.

In this way, each group's solution will be better than the individual one. When searching a solution to a problem, there is a continuous process of learning: first of all in the group context, where the particular solution is agreed on by general consent, and afterwards in the classroom debate where opinions and solutions of other groups are contrasted.

2.2 Support characteristics

In order for the computer software support to be effective, Boettcher et al. define the ACCEL model, which includes five necessary principles to facilitate the pupils learning [2]:

- Active. Learners take part in a learning program that requires thoughtful and engaged activity.

- Collaborative. Learners engage in discussions, activities and projects with fellow students.

- Customised and accessible. The learning program is designed to fit the needs and requirements of students in terms of time, career goals, levels of preparation, and learning styles.

- Excellent quality. Courses are designed to enable the learners to achieve desired goals and objectives. This learning support generally facilitates communication with professors and other students, and includes a fast and easy access to high-quality instructional resources.

- Lifestyle-fitted. Interactive distance learning accommodates to the lives of students, affording cost-effective educational opportunities anywhere, anytime, and at a reasonable speed.

These five principles have been applied in the developed support, considering some additional characteristics that are derived from the use of a computer software support:

- Computers do not encourage human communication, which is essential in a workgroup.

Computer media frequently forget the influence of human factors, which are involved in social and affective processes and, usually refer to informal and emotive relationships established among persons that belong to a workgroup. Sometimes, the expressive richness of human communication is lost.

Technological evolution makes it possible to develop new ways for interpersonal relationships, i. e. using videoconference support, which provides visual and oral synchronous communication. Nevertheless, this work introduces a simply designed easy-to-use computer software support, which provides the asynchronous and distributed communication among group members, workgroups and the teacher.

- Shared data must appear updated every time someone accesses them and there must not exist concurrence problems when several people try to modify the same data at the same time.

- Each group's data must be private, so it can only be accessible to its members and to the teacher, in case s/he wants to „have a look" at it, to assess the learning progress.

3. Computer based support

For a long time now, e-mail, news, schedule or multimedia data bases software have been available, separately. However, the real power of groupware is achieved when all these elements are incorporated into a single system [5].

This work is being accomplished by means of the technology offered by Internet in its World Wide Web service. This computer based platform allows interaction among all workgroups in a classroom. At any time, anyone can have at his/her disposal the updated materials, opinions, and designs, making workgroup possible, in the same way as sessions in a desktop, with the advantage of not having space or time restrictions for any participant, providing an asynchronous and distributed communication environment.

Consequently, it is necessary to analyze the interface that the computer based support offers for collaborative learning from two important points of view: environment and design characteristics.

3.1 The design

In order to facilitate navigation, a non complex environment has been created, which enables the user to access, from any page, the main pages that conform the workspace.

Web page design has been made following the structure showed in Figure 2, that defines the three virtual environments that conform the developed support:

- the classroom,
- the workgroup desktop, and
- the teacher's office.

MAIN LINKS	
The classroom	This page provides the virtual classroom environment, where it is possible to discuss and assess any workgroup solution.
The workgroup desktop	This Web page provides the virtual environment, where a workgroup is working.
The teacher's office	This link provides the teacher with the possibility to assess the learning progress of each person in the group environment, because it allows the teacher to access at anytime the workgroup environment in order to analyze the evolution solution. Besides, the teacher can manage the workgroup that conform a classroom, and assign to every group the access permissions.
The problem	The study case defined by the teacher is determined in this link.

Table 1: *Main links for the Web environment to apply collaboration learning.*

According to this structure, a Web pages set has been designed, from which it is possible to find hyperlinks that provide access to all the virtual environments showed in Table 1.

Finally, it must be taken into account that in the problem link there exists a hyperlink to a software development tool that follows the object oriented programming paradigm. By means of this tool, the shared information is compatible among the different pupils that constitute a workgroup, and among

the groups in the classroom.

3.2 Environment characteristics

Students have access to the information server via World Wide Web either by modem from their home or office, or from computer labs on campus. Using the environment described on Table 1, students can interact with their own group and with other groups in an asynchronous manner.

This computer based support consists of a set of Web pages created using HTML combined with CGIs, which, in most cases, generate HTML code, permitting interactive and dynamic Web pages. The system is a customer/server environment, where customers are students (and also the teacher) and the server is a Windows NT machine, all of them connected to Internet.

The communication existing among group members is an indispensable requirement to study a case. Moreover, information, opinions, design and changes that may take place in the study must be continuously updated and available at the same time as they are generated, by using CGIs which are incorporated in the Web pages.

To maintain privacy of the data handled by each workgroup there is a users registry system, where users and workgroups, they belong to, are recorded. Access control is achieved by a CGI that checks the user name, the group, and the password to access private information pages.

Besides, to maximize interpersonal communication, discussion and opinion pages are offered, divided into group pages and classroom pages. In case someone that is „listening“ decides to take part in the debate, s/he can express his/her opinion filling in a quite simple form. When this form is sent, a CGI updates the debate page, adding the new opinion.

4. Conclusions and future activities

Nowadays, this computer-based support is being used experimentally on a reduced scale with satisfactory results, with the purpose of assessing the fluency of communication.

This path is an alternative to mitigate the collaborative work problems in a crowded classroom,

allowing the application of workgroup methods in standard and distance education.

Based on this experience, we think that potential and performance of computers in education can only be effective in the classroom when the technology is fully integrated into the University curriculum, not focusing on the technology itself. To this opinion, Butzin adds, „[…] the classroom environment must be transformed to accommodate active learning [...]. Then we realize the possibilities of technology to improve education“ [3].

Currently we are studying the possibility to extend the support with a videoconference system, which may incorporate a virtual conference hall that allows the synchronous communication between workgroup members.

Also, messages written by the users must have options to encrypt, sign or both. In the first case, the message is encrypted, thus ensuring its interception is not a disaster, whereas, the second option authenticates the author of the message, so that it is possible to obtain the warranty that the message has been written by the person who appears on the head as the author.

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