

HCID: An Experience in Collaborative Work and Distance Education

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Abstract: The paper describes an experience in collaborative teaching/learning using INTERNET and World Wide Web [Zeltzer 95]. A teaching/learning environment that provides tools for enhancing the communication process between all participants in the experience was build by adapting and enhancing existing tools currently available in the Web according to the specific needs of the project. A prototype of the environment is currently being used in the development of a distance education course related to human-machine interface issues both as a tool and as a study case.

The Problem

We are developing an effective mechanism for offering a distance education course using INTERNET and the World-Wide Web. In particular, a course on Human-Computer Interface Design was considered as a study case. For all operational purposes, the instructor was located at Buffalo, NY, USA, and the students were at Universidad de Concepción, Concepción, Chile.

We defined an effective mechanism as one able to provide the following services:

- Documents sharing: Suggested readings must be available for revision, discussion, and, eventually, modification by all participants.
- Message sharing: Messages must be shared by the participants with minimum effort. Emphasis must be in content, not in operational aspects.
- Idea sharing: Ideas must be shared, if it is possible when they arise, so that the participants can be engaged in active discussions about the ideas and their relation with other materials.

Methodology

Following the ideas proposed by Fainholc and Derrico [Fainholc & Derrico 94] we consider the following aspects during the development of environments and materials for open and distance education:

Epistemological Aspects

- a) Structure of the domain knowledge.- It is defined by the course curriculum.
- b) Methods and techniques involved in knowledge acquisition.- The student knowledge acquisition process is supported by the following activities: Bibliographic research, conceptual structure diagram construction, informed discussions, info repositories, critical evaluation of documents and software products, individual and collective prototype design and implementation.

c) Symbolic codes of media involved in the transmission of knowledge.- The accessibility to multimodal information and tools for real-time multimedia communication provides us an interesting environment for analysis and discussion about the way in which each media contributes to the communication process, both in isolation and in combination with other media.

Psychological Aspects

- a) The level of the user.- In our case, undergraduate and graduate students.
- b) The learning theory adopted.- A constructivistic, cognitivist, interactivistic theory.
- c) The comprehensibility of the material based on the cognitive and meta-cognitive abilities of the participants in the experience.- Besides the exposition to the huge amount of material available through WWW might be considered as a potential cause of cognitive overload, it provides the possibility of getting a broad view about particular issues. As participants in the course not necessarily review the same material, concepts and positions can be discussed from different points of views, according to the motivation of the students.

Sociological Aspects

a) The communicational model and relation styles that they support.- The communication model considered during our project consider the following actors: instructor, researchers, students. The following interaction styles are considered and supported by the model:

- Instructor and students relate each other in two modalities: Tutor-tutored, and as peers.
- Students relate each other as peers. Eventually, some student might adopt the role of leader and conduct the communicative process.
- Researchers, instructor, and students relate each other indirectly via documents and, eventually, they might be in direct communication via E-mail, text, audio or video-conference.

b) The interactivity and the social production of culture.- We strongly believe that the key for learning is interaction. In our conception, the instructor, more than an information provider, becomes in a facilitator of interactions between students, and between information sources and students. Instead of presentation of canned definitions for concepts, activities are oriented to develop a social construction of meanings via negotiation of individual understanding of the concepts.

Semiotical Aspects

a) Creation of cultural meanings.- As it was mentioned above, concept meanings emerge from discussion, providing common grounds for further interactions between the participants in the experience.

b) Creativity.- Through analysis, comparison, and contrasting positions new ideas arise providing new solutions to problems. The accessibility to the newest sources of information and tools for searching, retrieval, distribution, and access provides continuous challenges to the participants as they realize current limitations of the state of the art in their area of interest.

Didactical Aspects

The mixture between passive and active positions in learning.- By mixing reading, discussions, testing, and prototype analysis and design we cover the spectrum of positions in learning, enabling the students to exploit their personal abilities and preferences, as well as to explore alternate ways of facing the learning process.

Operational Aspects

From an operational point of view, participants relate each other according to the following guidelines:

- A set of materials is initially available to the students (course description, course schedule, suggested readings, course notes, project descriptions, etc.)
- Each participant can propose enhancements to existing documents (in particular, course notes, by attaching hyper-links to those concepts he/she considers interesting).
- Answers to exercises, homeworks, and projects from each student are shared with all participants for comments and discussion.
- Periodically, a virtual meeting occurs. These meetings are oriented to discuss issues about course notes, suggested readings, projects, etc. During these meetings all participants have equal access to all information and they are supposed to engage in active discussion.
- Discussions are recorded, being accessible to each participant at the end of each meeting. This provides both, a mechanism for reviewing the discussion process and the concepts involved in the discussion, and the possibility, for those students that did not attend to a particular virtual meeting, of submit followup comments contributing also to the discussion of a particular topic.
- At any time, a participant can send to the others participants questions, comments, etc. about some content/course-related issue. Messages can be shared with the other participants, being available in a central repository for further revision.

Experiences

Experience 1 - 1994

During the second semester of 1994, the Human-Computer Interfaces course was offered. Students were introduced in the use of WWW for message and document sharing [Hong et al. 94], [Rebelsky 94], and UNIX tools (talk, ytalk) oriented to support interactive dialogue. Virtual meeting interactions were recorded for further analysis. They were available as HTML documents to all participants.

The mixture of different tools in the development of virtual meetings and network stability and response times were the two main problems detected during this first experience. As expected, students showed a strong preference for interactive on-line discussion in contrast with off-line discussion via E-mail.

Experience 2 - 1995

Based on the results of the [Experience 1], and trying to enhance the development of an inter-subject consciousness about the topics of the course, during 1995 we developed a WWW-based integrated environment for collaborative work (HCID) oriented to promote cognitive processes such as: analysis and discrimination, generalization processes, reflection, discussion, problem solving, conceptual organization, and heuristic research.

As part of this effort, we reviewed different interactive tools for audio and video-conferencing [Ibrahim & Franklin 95], [Dwyer et al. 95], and we evaluated them from the point of view of usability. The conclusions of this study were considered in the development of a prototype version of HCID that enables the participants to share ideas interactively during virtual meetings and provides automatic actualization of the shared information space each time that a participant contributes to the conversation. This prototype is currently being tested by our students.

The environment

The design of the environment was based on previous studies about the tools students use during their learning process [Campos et al., 94], [Campos & Claveria, 95]. The structure of the system is shown in [Fig. 1]. The modules considered are:

- Course information: Syllabus, rules, evaluation, participants.
- Reading/working materials: Handouts and on-line interactive tutorials.
- Homeworks and projects: Project proposals and development history, homeworks and results. This module is linked to the homework and project pages in each student account.
- Virtual Library: Search Tools and pointers to topic-related interesting places.
- Virtual classroom: E-Mail and tools for multimedia (WebChat-m), audio (InternetPhone), and videoconference (Cu-SeeMe).

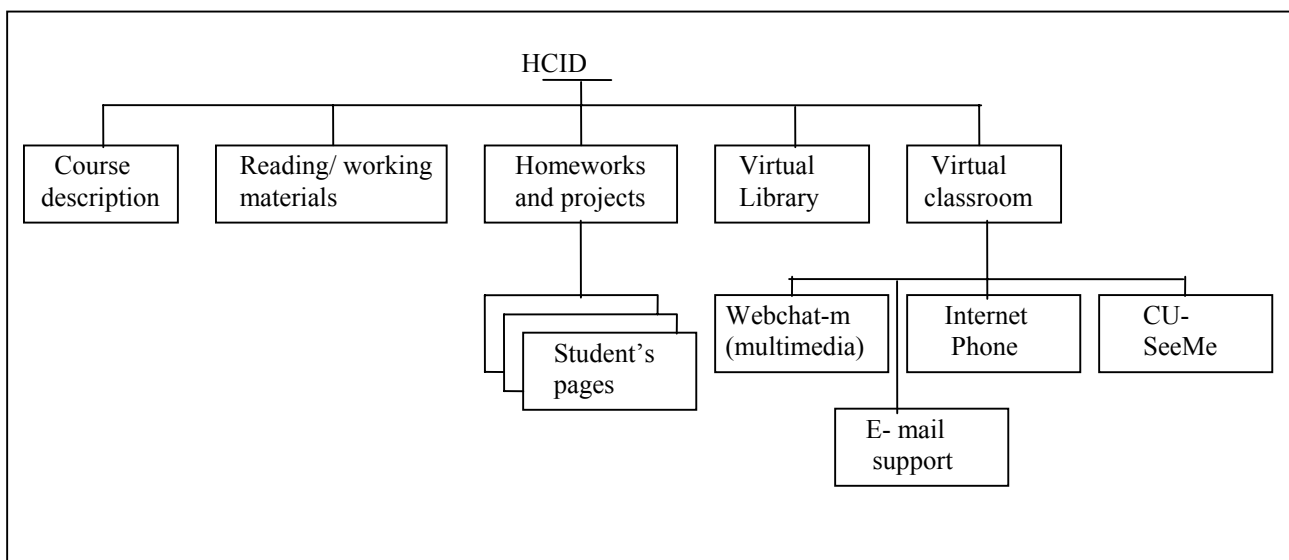


Figure 1: The structure of HCID.

Results

We are developing a framework for distance education using WWW that provides an environment for delivering instructional material and mechanisms to achieve an effective communication with the students. This framework is currently being used to offer a course about human-computer interfaces in which usability testing and further development of the environment are, by themselves, some of the most important activities. The active participation of students in the experiences described above, has been a critical factor for the success of the project.

Having exposed the students to different tools and setups, it is interesting to note the importance of student's expectations in relation to services and response times of the different interaction-support tools of the environment. Students preference for completely on-line or completely off-line tools, instead of *almost real-time* tools was clear.

According to the experiences, the environment usually acts as a trigger for motivation, as the student role changes from passive learner to a partner in the goal of constructing meaning and understanding through interaction.

Conclusions

Our proposal can be related with a cognitivistic, constructivistic and mediatic conception of the teaching/learning process based on the idea that the knowledge building process is only possible through interaction between the subjects and the objects of knowledge that can be mediatized either presentially or at distance.

The relativization of perspectives, the access to different styles of information coding according to the media used to convey the information, the challenge of facing different points of view and contradictory opinions about some issue, are some aspects emphasized in our project.

It is not a simple task to help subjects to learn by themselves. Instructional material must fit with subjects' schemes and their cognitive tools. But, simultaneously, current schemes and cognitive tools must be improved. The development of teaching/learning environments as the one described in this paper is a way of facing both goals simultaneously.

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