LOW COST REAL TIME COLLABORATION ENVIRONMENTS IN DISTANT ARCHITECTURAL EDUCATION:

An effectiveness study

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Abstract. We describe here an experiment comparing teaching, supervising and discussing design projects through two different real time collaboration systems setups with developing the same activities on site. A group of students taught on site was compared with another taught through a low cost real time collaboration system.

1. Introduction

Distance learning in Architecture is incipient. The main difficulty is due to the need for teachers and learners to simultaneously see, manipulate, and discuss the artefacts being designed in the same environment.

The high cost in the communication systems for discussing design in real time at a distance is a major issue. Most research has focused on expensive setups (for instance, see Velasco, 2000). We here call expensive those setups budgeted above US$8,000.00. This limit was set in accordance to how much we could afford in setting up the server side in our particular institution and country. We also established as a low cost parameter the limit of US$1,500.00 in software and hardware plus no more than a US$50,00 monthly DSL connection fee for each client's side of the system.

We believe that real time collaboration systems, RTCS's, particularly desktop sharing, application sharing and voice chatting, with the server connected via a standard high speed network and the clients connecting via DSL, have the potential to provide such low cost environment for architectural distant learning.

Most publications in RTCS's involve system specification and evaluation (for instance, see Lonsing, 2003). Few authors focus on how much RTCS's environments are equivalent with onsite teaching or how these technologies affect learning in the design studio.

Keegan (1995) and Simonson at al (2000) regarded equivalence to on site education as the key criteria to assess the success of distance learning. Ko and Rossen (2001) consider that online synchronous courses can even compete favourably with traditional ones.

We describe in this paper an experiment comparing teaching, supervising and discussing design projects through two different RTCS's setups with developing the same activities on site. A group of students taught on site was compared with another taught through RTCS.

2. A low cost RTCS setup

Our project of setting up a low cost RTCS was developed so far in two phases as described in the sessions bellow.

2.1 A HOSTED SOLUTION

In the initial phase we tested an alternative setup with the lowest cost in the market. This resulted in using a RTCS hosted by the web server of another organization (http://www.gotomeeting.com). One of the problems with this setup was that this particular system did not provide a voice chat over IP, but over the telephone system. Since the provider was in a different country this option was not viable for us because all participants would have their telephone lines billed at international call rates. Therefore, we decided to use just the graphical interface resources of this particular system, that is, the desktop sharing, application sharing and session recording. However, voice chatting was essential for us in order to free the hands of the participants from having to type at text chatting boxes while at the same time to perform graphical actions in desktop and application sharing. For this reason we decided to use an additional hosted system which did not support desktop and application sharing but offered free voice chatting (http://messenger.yahoo.com/ and http://voice.yahoo.com).

The overall cost of this solution for our school was very low: US$49.00 per month paid only by the organizer of the meetings. The main problem with this solution was the reliance on three different servers, among which we had limited control upon only one of them. This resulted in considerable instability and poor performance due to the distance between our country and the country where the hosted system was based (GotoMeeting and Yahoo).

2.2 A SOLUTION WITH OUR OWN DEDICATED SERVER

In the second phase of our project we sought to set up a system on our own dedicated server so that we could have full control of RTCS's performance.

We manage to setup the server side of our RTCS, within the budget limit specified above, using an AMD based machine (Sempron 3000 Processor, with 3GB RAM and a 40 GB HD), running Windows Server 2003 and the RTCS application Linktivity (www.linktivity.com). The server hardware and operating system cost all together about US$3,000.00 and the RTCS application cost about US$5,000.00. Our server was connected directly to the University of Brasília high speed network without extra costs for our Faculty.

The clients can access the RTCS over standard DSL connection, if they are outside de University campus, using several different Internet service providers. Teachers and tutors usually access the system from within the University's network.

The meetings are held in the evenings, between 7 pm and 10 pm, because the experiment is part of a Computer-aided Architectural Design Post-Grad Programme that is run at night for part-time students (Silva, 2001; Silva & Lima, 2003, 2006). This brings the advantage of using the University's network and the Internet in a time when the overall demand is significantly lower than pick times (9 am to 5 pm).

The RTCS which we have setup allows for a simultaneous meeting of a class of 10 persons, involving students and two teachers, lasting about one hour and a half which one. In these meetings the teachers deliver tutorials, discuss design projects and clarify doubts of previous classes in real time. The system provides several resources, but we have mostly used desktop sharing, application sharing and voice chat simultaneously.

We have had participants from several different locations in our country some of them connecting from distance as far as 2000 km. Figure 1 below shows a view of the desktop of our meeting host at the Faculty of Architecture of our university.

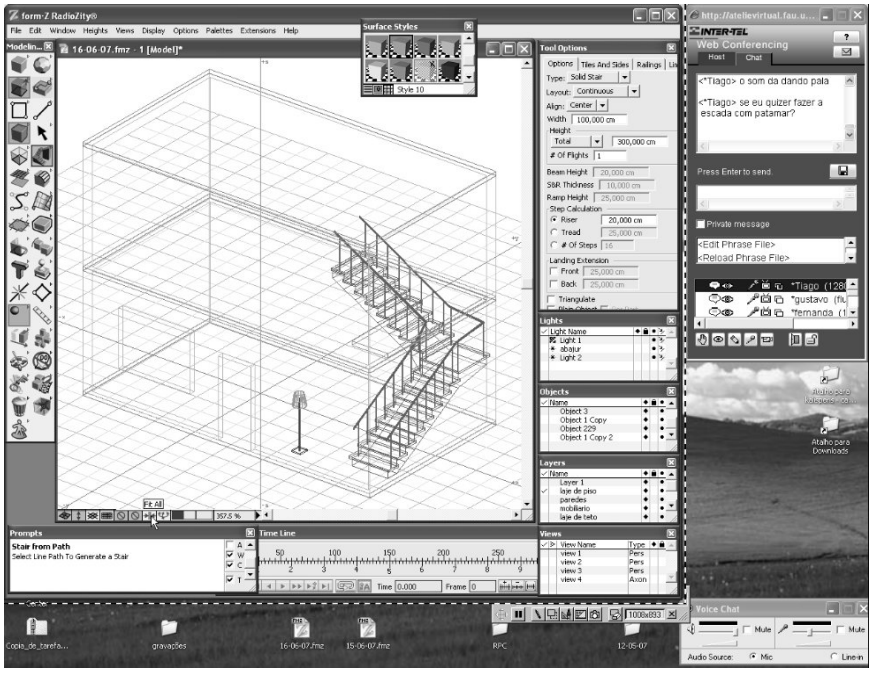

Figure 1. A view from a host desktop.

The area within the dotted line square is visible to all the other participants connected to the long distance class. The window on the right upper corner is the host control panel containing also a text chat window.

The viability of simultaneously seeing, commenting (through voice and sketching) and manipulating three-dimensional computer representations of architectural artefacts was vital for our project. Therefore, the amount of delay was a key criterion in assessing our experiment. We found out that the second phase solution, that is, the dedicated server one reduced substantially the delay in relation to the previous phase.

Figure 2 below shows the desktop of a host showing graphic information of another design discussion.

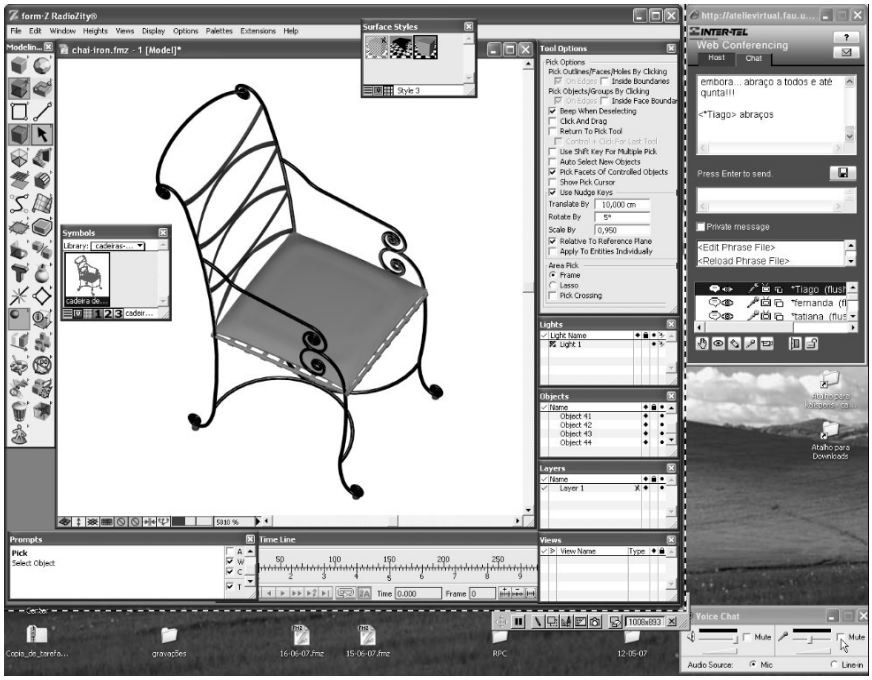

Figure 2. Another view of a host desktop is showing graphic contents in a design discussion.

As in other RTCS's, the contents of any participant's desktop could be broadcasted to all the other participants in the meeting. Besides the teacher, any participant could make questions in the text boxes or through voice chatting and also draw annotations with different colors on the design being presented. A student, for example, that was presenting his design task received the system controls from the teacher in a way that all presents to the class could see his computer screen e hear his voice, make and answer questions made by any other participant. Each student is expected to participate actively in these long distance classes that were planned mainly for tasks presentation and clarification of doubts about the contents delivered on site.

3. An assessment

In this section we compare the setups organized in three groups according to the resources available in each context of our experience with teaching: on site - OS, at a distance (hosted by third party web server) – Dh, and at a distance (in our own dedicated server) – Dd of teaching experiences through the following questions:

The Table 1 below shows the results of the comparative study using the same blocks of questions for each of the setups:

Question	**On site**	**At a distance (hosted)**	**At a distance (dedicated server)**
1. Did the commutation system affect the learning experience?	yes	yes	yes
2. Was there a different learning pace?	yes	yes	yes
3. Was the voice communication speed slower in any way?	no	yes	yes
4. Was the voice communication speed significantly slower (more than 5 seconds)?	no	yes	no
5. Was the voice communication speed faster in any way?	yes	no	no
6. Was the voice communication speed significantly faster (more than 5 seconds)?	no	no	no
7. Were the variations in communication speed frequent?	no	yes	no
8. Did the learning experiment require changes in different teaching methods?	yes	yes	yes
9. Did the learning environment impose particular constraints on the lectures?	no	yes	yes
10. Did the learning environment offer advantages for the lectures?	yes	no	no
11. Did the learning environment impose constraints on tutorials?	no	yes	yes
12. Did the learning environment offered advantages for tutorials?	yes	no	no
13. Did the learning environment impose constraints on group discussion?	no	yes	no
14. Did the learning environment offered advantages for group discussion?	no	no	no
15. Did the learning environment imposed constraints on individual participation?	yes	no	no
16. Did the learning environment offered advantages for individual participation?	no	yes	yes
17. Did the learning environment induce any loss of attention in relation to the other group?	no	no	no
18. Did the learning environment imposed constraints on architectural design supervision?	no	no	no
19. Did the learning environment offered advantages on architectural design supervision?	no	yes	yes
20. Was the level of student absences visibly higher than the	no	yes	yes

other group?			
21. Was the level of drop out visibly higher than the other group?	yes	no	no
22. Did the learning experience encourage a higher rate of students per teacher?	yes	no	no

The questions above were thought, to constraint as much as possible the universe of possible answers into a yes or a no in order to facilitate any comparison among the setups. Several pairs of questions are mutually excluding, such as questions 3 and 5, 4 and 6, 9 and 10, etc. Other questions are independent, such as questions 8, 18 and 19.

Generally speaking the learning experience at a distance using a dedicated server was better than the one using a hosted system by a third part web server. The speed of voice communication of the dedicated server was yet slightly slower than on site experience, though not as much as in the case of the hosted system. There was no delay in the graphic and text transmission and the images were of high quality.

It is important to stress that the learning process was successful through this way of delivering and permitted students from different states to access the classes that otherwise they would not be able. The RTCS allowed also each student to present his or her design, receive the comments and colourful annotations and drawings made by the teachers, and clarify their doubts under the observation of all the other participants in real time.

One of the surprising results was an improvement in the participation of the students. Some of them who in an on site environment would remain silent had a higher rate of participation, making questions, presenting their works, etc. Differently of what happens in the on site class, in the RTCS a student would make a question, reply to the teacher again and again until his or her doubt was completely clarified pointing to obvious gain to the learning process.

Above these advantages there is another one equally important. Owning to the fact that the tutorials were recorded, the students could watch them again as much as they needed and all the class could benefit from the questions made and explanations given.

4. Conclusion

The results yet show some technical problems to overcome regarding system configuration, connection speed and reliability. They required development of different meeting techniques. No evidence was found for increasing the rate of students per teacher. However, the overall results were promising and there were important advantages to the learning process. The RTCS are in

fact a low cost viable alternative to expensive setups. Above all, the design studio supervision was of high quality, perhaps better than onsite, facilitated the learning of a new subject, was helpful to clarify doubts and reinforced a taught subject, whenever the technical problems were overcome.

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