On-Line Education in Computer Networks Courses Study Case: UABC University, México

Marlenne Angulo and Marco A.Turrubiartes
Universidad Autónoma de Baja California, México

mangulo@uabc.mx mturrubiartes@uabc.mx

Abstract

Currently, distance learning is increasing its application in Mexican Universities; despite that it is not enough to satisfy the demand of higher education in Mexico.

This paper presents a comparative analysis of undergraduate student performance in two systems: face-to-face and On-Line education. This analysis was realized with two different courses: Local area network and Interconnectivity. These two courses are part of the Computer Engineering curricula. The results show two important issues: the students are more participative and the team work is improved in the on-line class.

The original idea of this work was to quantitatively evaluate face to face and On-line educational systems applied in computer networks. Finally they could not be compared in that manner. Both systems are options that the students have, and according to their profile they can choose the most convenient alternative.

Finally, the Internet is a tool, it does not give better or worse education by itself, it has some advantages/disadvantages that should be taken into account when an On-Line course is designed.

Keywords: On-Line Education, Computer Networks teaching, Educational Models

Introduction

In México, educational institutions have been using distance learning for more than 50 years, however, has being applied to basic/medium education, mainly because there was a huge demand in rural populations. Nowadays, higher education expects an increase greater than ever, in contrast to the basic education.

In México, specifically in UABC, On-Line Education has two problems to avoid:

- Although the university has computer networks infrastructure, it's not enough to satisfy the requirements, considering that not all students have internet at home.
- Educational paradigms presenting some resistance to transform the traditional education.

However, there is an important group in the University that is promoting On-Line Education development, encouraged by the National association of universities and higher education institutions (ANUIES). This group is justifying On-Line education in México because the students' amount is expected to increase 150%, before 2020, which oblige to increase the number of classrooms, and the hardware infrastructure for laboratories. On-line class and virtual laboratories are alternatives

Paper Accepted as a Short Paper

in order to avoid a big investment to fulfill the higher education demand.

Distance education uses different resources such as: lectures, audio and video tapes, satellite and Internet/Intranets. The majority of distance *education* is a passive way of learning, based mainly in reading or listening. WWW offers the opportunity of sending multimedia, which *does not assure* but allows an interactive way of learning. This paper topic is distance education, specifically On-Line Education.

The remaining of the paper is organized as follows: Section 2 provides a brief overview of Educational Models followed by section 3 by the description of On-Line Education. Section 4 describes the offered courses, and their proposals. Finally section 5 concludes this work.

Educational Models

An academic group in UABC University supports an educational training for teachers called 'Pedagogical Identity in the University', which promotes that teachers encourage students to construct their knowledge, acquiring new things based on well-known things, being an active information processor and responsible in their learning and skills development, using their knowledge meaningfully and trying to generate critical and creative thinking. In this section is provided a brief description of the theories that this plan consider.

Before Vygotsky appeared, the theories showed an isolated and individual person, he was the first conceptualizing a person as a social being, formed by social and cultural processes (Wertsch, 1985).

Vygotsky founded the socio-cultural theory in psychology.

Some theories assign to the teacher the function of commander of teaching-learning process; other theories conceptualize him/her as a guide or inductor (Collison, 2000), Vygotsky's conception is the professor in both positions, but at different time. (Wertsch, 1985).

According to Ausbel, teaching allows to acquire new knowledge based on the well-known things. Besides, Robert Marzano proposes a way to acquire and integrate knowledge to *store declarative knowledge and internalize procedural knowledge*. (Marzano, 1997)

Bruner defines a student as an active information processor, responsible on his/her learning, moreover the student should be self-learning.

Robert Marzano gives the assumptions that Learning involves a complex system of interactive processes that includes five types of thinking (represented by 5 dimensions). Dimension 1 recommends helping students to develop positive attitudes and perceptions about classroom climate and classroom tasks. Dimension 2 focuses on acquiring and integrating knowledge (declarative and procedural). Dimension 3 suggest that the extended and refine knowledge will be achieve by comparing, classifying, abstracting, inductive/deductive reasoning, constructing support, analyzing. Dimension 4 proposes the use of knowledge meaningfully. Finally, Dimension 5 talks about critical, creative and self-regulated thinking. (Marzano, 1997)

On-Line Education

WWW is an attractive delivery system of Multimedia that affords an inherently better way to teach (Brooks, 1997), we assume that multimedia *does not guarantee* a better way to teach, meanwhile, it is really helpful with the students' diversity, for some students is easier to listen audio or watch a presentation, than reading a book. However is more important to design the courses not only with multimedia also in active learning scheme, allowing the interaction between students and student-teacher.

It is important to mention that On-Line Education in Computer networks area has the advantage on having virtual laboratories that allows interactive-learning without a huge laboratory infrastructure.

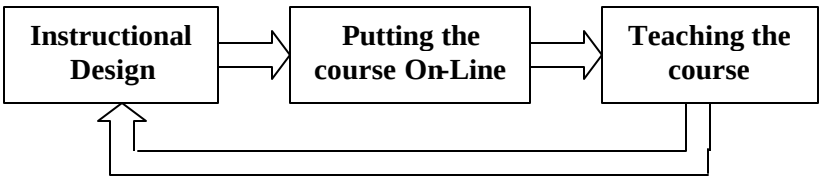

Figure 1. Flow Diagram for On-Line Course Development

Figure 1.- Flow diagram of On-Line courses development

There are three big steps to follow in On-Line courses development; Figure 1 shows a flow diagram that describes them.

1. Instructional Design

Before an instructional design is developed, it should be specified: objectives, skills and habits that the student should have at the end of the course. It is very important to know well-defined objectives before a course is designed, in order to develop it in a structured way, which will facilitate the teacher to find activities and contents according to the course (Newby, 2000).

The course objectives are transcribed in products which demonstrate that the student develop the desired skills and use the knowledge meaningfully. The actions to make those products must be clearly redacted, specifying which lectures or Power-point performance should be used, the characteristics of those products, when must be finished, etc. A product could be a participation in discussion room, a power point presentation, or a word file describing a network design.

The course must be divided into modules with well-described schedules, so that the students can plan when to sign, and when to meet their teams.

2. Putting the Course On-line

They are different platforms to upload a course: Web CT, Virtual U, etc., most of them have synchronous conversation (chats), asynchronous conversation (discussion rooms), and a space for downloading text, up-load homework.

It is important for teachers to have an easy to use platform, if the teacher does not have a solid group that works with technical matters, it will be hard to the teacher to deal also with the platform. Anyway, teacher as On-Line designer spends more time preparing teaching materials, in order to bring out quality material. Recently a group in the university produces a *UABC virtual* platform (proprietary software); this software will let the teacher to upload a course easily.

It is important that the course do not confuse the student. Students must have a clear idea where to find their information sources, or where to upload their work. It is very important that the windows will not be full of writing; from the beginning On-Line education should be something attractive for the student.

3. Teaching the Course

During the course operation the teacher could act as a moderator in student-to-student interaction. There are three principles of effective moderating: Moderating takes place in both a professional and a social context, the style of "guide on the side" is most appropriate for leading a virtual learning community,

Online moderation is a craft that has general principles and strategies (Collison, 2000)

As we said the asynchrony in Online gives some advantages, but it must be seriously consider the timely responsiveness, could be really frustrating for a student to wait long time for a teacher answer, mean-

while the teacher must be following the student-student interactions in order to encourage them if their participations are not the expected.

Offered Course Descriptions

This paper presents a comparative analysis for undergraduate students' performance in two methods: face-to-face or On-Line education. This analysis was made in Local area network and Interconnectivity, a Computer Engineering bachelor courses.

Local area networks and Interconnectivity courses were implemented in two platforms: Virtual U, and a proprietary design developed with Front Page (including some java scripts). Those courses are part of the computer engineering curricula. The instructional design was based on Learning Dimensions of Robert Marzano (Marzano, 1997).

We will describe Local area network (LAN) course:

- Course purpose: Design and analysis of local area networks, and to develop in the student critical reasoning that allow him/her to take the optimal decision in computer networks implementation or modification
- Formative Objective: Encourage the student to develop creative and critical thinking, and responsibility in the work.
- Informative Objective: To analyze protocols and standards where the operation of Local Area Networks is based, and the design redesign or networks based on structured cabling standard.

From the general objectives there were obtained five modules with their specific objectives, each module was scheduled into weeks, every week has its own assignments.

The instructional design of this specific course is not presented, however there is presented a brief description of LAN on-line course, where the structure is similar in both courses.

After the logging process, the first window presented to the student is the main window, which contents a flow-diagram of the course modules, described as units, as well as the beginning and end buttons; figure 2 shows the main window.

Before going through Unit 1, the student should take the beginning button. The beginning window has two functions: first, gives to the student general information of the course as the importance of this course, the objectives, etc., Second, and considering that for most of the students this is their first On-line course, this window includes information about: what is an Online Course and how it will be managed this course, what to expect form the course and what is expected from de student, and how is evaluated the course. In the arrow link before the Unit 1 is started there are some routines to 'sociably' and to create a cordial environment in the course, some of them are trying to make the student attracted by the course.

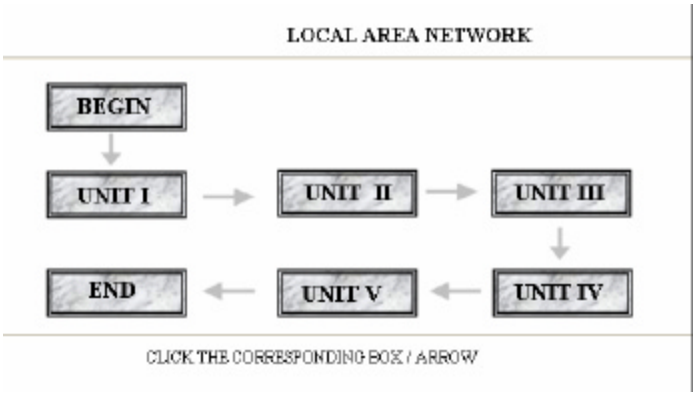

Figure 2.- Main window of Local Area Network course.

Unfortunately the contents depicted in figure 2 and 3 are in Spanish, they are presented to show how the information is presented to the student. Figure 3 shows that the topics presented in this window are in the left side (in blue), allowing a quick ac-

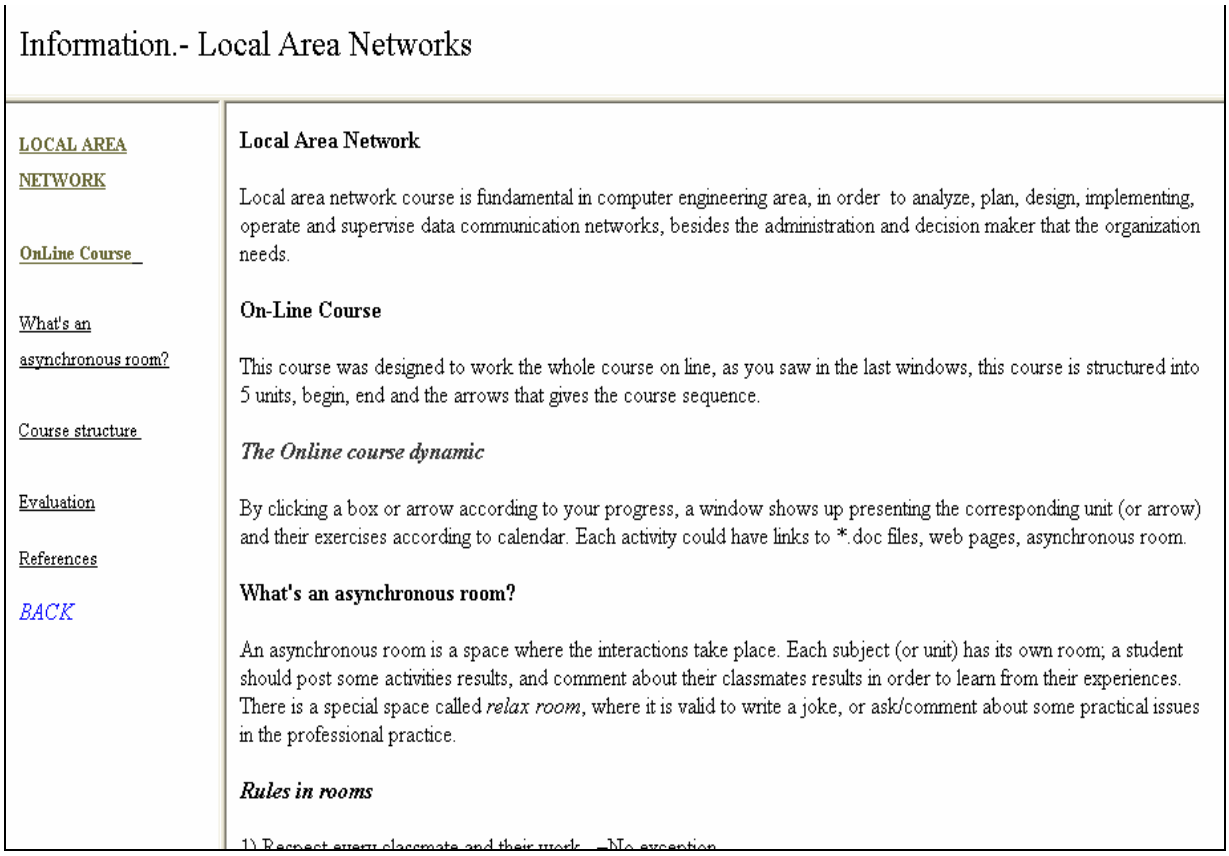

Figure 3.- Information window of LAN course

cess to the information, the top of the window holds the windows title, and has a link to go back to the main window.

Most of the Unit windows are as follows: In the left side has the activities links, the main space shows the proposed activities for the unit, the course is scheduled by week, so a week could have from one to three activities depending on their complexity, each activity has its link to the information source, such as: lectures, videos, power point presentations, etc., also has a link to discussion rooms,

If the activity should be developed in group, it has a link to a chat room in order to provide a quickly way to organize the activity, however the team must set up their appointments (usually through e-mail). The activities product could be uploaded to a specific room or send it to the moderator through e-mail.

Anyway the moderator e-mail is available in all windows. Figure 4 shows the unit two window.

In On-Line courses, we found that for this area the student-student interaction is very important to *build* their knowledge. On the other hand, this kind of System helps the student to develop self-learning abilities which is necessary in order to track the fast advance in computer networks.

Analysis and Conclusions

Analysis

The results presented are an average of the results obtained during three semesters. There were no significant differences between the results of each semester.

There is a group of parameters to analyze during a course, but focusing in Local Area Network course, the following parameters were analyzed: Responsibility, critical and creative thinking. These parameters were measured based on student participation and production. Team work was also analyzed.

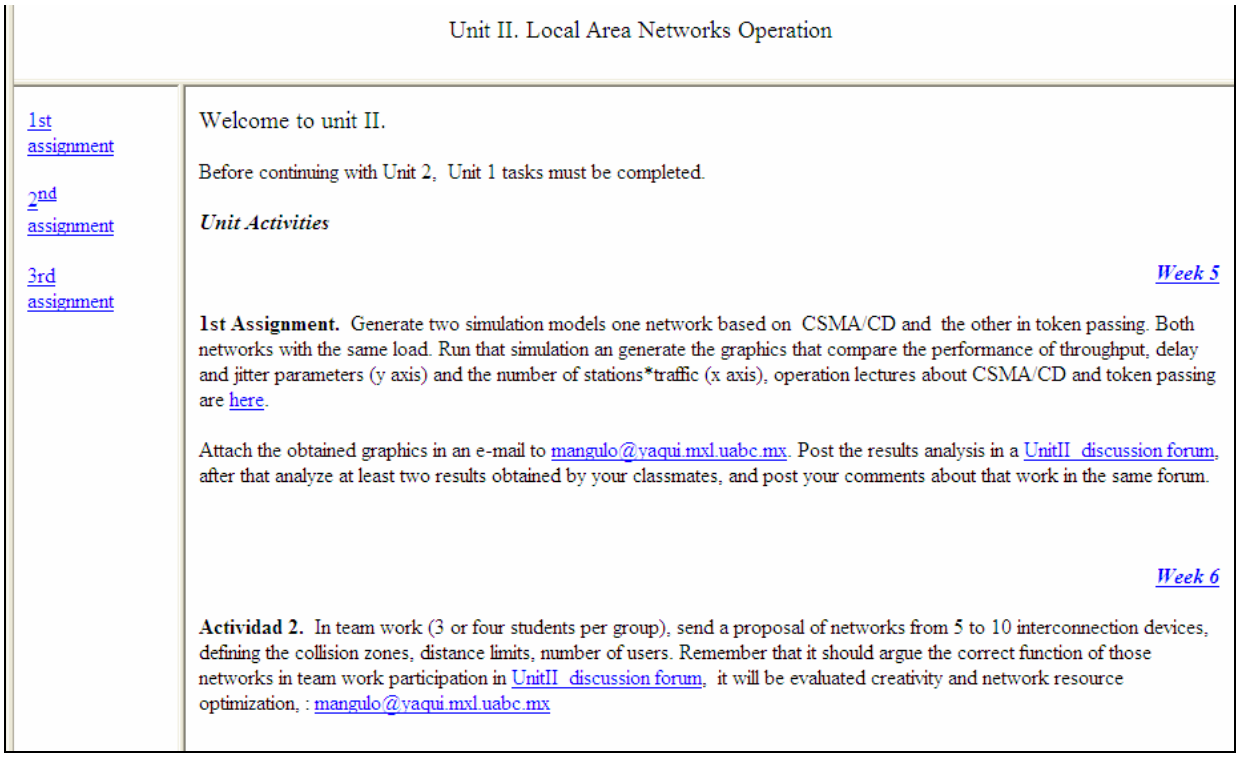

Figure 4.- Unit two of LAN course

Responsibility was measured by the percent of students who completed their work with all the specifications before deadlines. Creative thinking was measured in how many creative alternatives of network scenarios were designed/ re-designed, out of conventionalism but working with adaptability, scalability and robustness. Critical thinking was evaluated comparing student participation in round-tables (face to face) and in discussion rooms (Online). Table 1 shows the evaluated parameters where the percentile was mapped into high, medium and low categories.

	Face to Face	On Line
Responsibility	High	High
Creative thinking	High	High
Critical thinking	High	Medium
Team work	High	Medium

Table 1.- Evaluated parameters for Formative objectives

Because student participation is required in an Online course, an increase was expected in this parameter. In face to face format we have more spontaneous participation; on the other hand those participations are not passing through a *detailed* thinking process.

In On-Line classes the students show a committed attitude, having more participation than face-to-face students, one reason is that in a traditional class the teacher is the authority, and the student assume that their comments are less valuable than the teacher's word, on the other hand, in traditional education sometimes the student doesn't have enough time to structure a good participation, and in On-Line he/she has it, because most of participations are in asynchronous discussions, excepting chats where generally this kind of synchronous conversation is not evaluated.

On average in the On-Line courses evaluated, the work developed by Students' groups shows better quality than the traditional education, since the student-student interaction is improved.

An important point to consider is the fact that in On-Line education before the class starts the teacher should structure the whole course with the objective perfectly delimited, meanwhile, the traditional class gives more flexibility in the teacher's work, allowing sometimes a month by month even week by week constructed course, which could result in an unfocused course.

We found very satisfactory results applying On-Line education in computer networks area, besides; there is a big problem in engineering with undergraduate students: writing *dis*-abilities, we expect that on-line education move forward the students to improve their writing abilities.

Conclusions

We found two important issues: the students have more participation in on-line class and the team work is improved. Besides, in computer networks area is easy to introduce virtual laboratories in order to develop students' skills such as structured, critical and creative thinking.

Finally the Internet is a tool, it doesn't get better or worse education by itself, it has some advantages/disadvantages that should be taken in consideration when an On-Line course is constructed. In that way, the student will have options, and according to his/her profile they might choose the more convenient alternative.

Future Work

The next stage of our work is to evaluate On-line teaching methods.

Acknowledgement

The authors want to thanks the Engineering Faculty in UABC, for their sponsorship in this project.

References

ANUIES -National association of universities and higher education institutions. (1998). Open and Distance higher education plan. Mexico.

Brooks David W. (1997). *Web-teaching: a guide to designing interactive teaching for the world wide web*. Plenum Press, New York.

George Collison et al. (2000). *Facilitating Online Learning, Effective Strategies for Moderators*. Atwood Publishing, USA.

Marzano R. et al. (1997). *Dimensions of Learning Teacher Manual*, Ed. McREL/ASCD.

Newby T.J et al.. (2000). *Instructional Technology for teaching and learning Instruction, Integrating Computers, and Using media*. Prentice Hall, New Jersey.

Wertsch James V. (Ed.). (1985). *Culture communication and cognition: vygotskian perspectives*. Cambridge, Cambridge University Press.

Biographies

Marco Turrubiartes (IEEE member) is professor at University of Baja California. He has taught data communications and computer network courses in several occasions. Currently he is director of a Voice over IP project at the university. His current research topics are Quality of service in data networks and OnLine education.

Marlenne Angulo (IEEE member) is professor at University of Baja California. Currently she is working in the production and design of didactical material by using new technologies. She is also participating in a university project called a Voice over IP. Her current research topics are multimedia over data networks and Online education.