The NetLab experience

Moving the action to electronic learning environments

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Abstract

In 1995 University Fernando Pessoa set, as a requirement for admission, that every first year student should have a portable computer. The University offers courses in areas such as social sciences, psychology, management, literature, advertising, and engineering, and wanted its students to acquire the basic skills to use, interact and survive a information sea similar to the one that they will encounter in an information society environment.

Today (fall 1997) we have about 2300 students and 25% of the staff with notebooks and a 400 'plug-in' network to support then. The total population of the University is 4500 students and this is now a three years project that covers 53,5% of the total university students. This paper describes a particular use of the information system that generated a virtual organization enhancing the University concept of a dialogue community: the so called NetLab.

Introduction

The Internet has been revealing as one of the great phenomena in what refers to the adoption of new information technologies by non-specialists. Every day more people use computers because they want to have access to Internet (Kerkhove, 1996), (Bellman, 1996).

There is now an enormous community of Internet users that possesses a competitive advantage on the others, the joy of the benefits offered by the Internet offers a high potential. These benefits include the access to the available information, the research of a given knowledge area and the communication possibility with the other users on the net (Rheingold, 1993).

The use of the Internet introduces a new way of working with the information and with the knowledge, creating alternative forms of study and of research with direct impact in the process of Teaching-learning (Harasim, 1995), (Leibrandt, 1997).

Another great potential is the possibility to communicate among students and between professors and students in new forms, starting new forms of collaboration mediated by technologies (Gouveia, 1996). These possibilities are made possible by the availability of existent infrastructures: a local area network, the fact that every student has is own notebook computer and the existent network entry points in the classrooms (Gouveia, 1997).

The environment: Fernando Pessoa University

University Fernando Pessoa is the merging result of two Institutes in the year of 1994. The University had a significant growth in 1995, with more students, professors and more activity regarding extra curricula like conventions, seminars, debates, oriented small courses and workshops. It is located in Porto, Portugal is second large city.

Now the University (1997 figures) has 4500 students, 250 lecturers and an administrative staff of about 80 people. The students belong to four different departments: Administration Sciences (Ciências da Administração), Communication Sciences (Ciências da Comunicação), Political and Behavioral Sciences (Ciências Poíticas e do Comportamento), Science and Technology (Ciência e Tecnologia). Presently the University offers twenty courses and three graduations.

The first year students of all courses have a notebook as a requirement for admission at the university. Table 1 gives the minimal specifications for the notebook computer. In the first project year (1995) there was a contract with a computer campany to supply the notebooks. In the second and third years there is just a public announcement of the minimal specifications and each student can buy his computer following the recommended university proposals or buy another that meets these requirements.

Year	Hardware	Software (student license)
1995	Intel 486 dx50MHz, 4 MB RAM, 270 MB HD, LAN pc-card	MS-DOS, Windows for Workgroups, MS Office 4.1
1996	Intel Pentium 100 MHz, 8 MB RAM, 840 MB HD, multimedia, LAN pc-card	Windows 95, MS Office Pro 95
1997	Intel Pentium 133 MHz, 16 MB RAM, 1 GB HD, multimedia, LAN pc-card	Windows 95, MS Office Pro 97

Table 1: notebook minimal specs

The network infrastructure for the project is based in LAN connectivity. It started late 1995, with Ethernet 10 Mbps LAN in labs and classrooms, with 170 DHCP entry points and 1 server (Windows NT, Intel box). In 1996 it evolved with LAN segmentation with 300 entry points, includeding the library. In this phase there where started our intranet services: www, ftp, mail, proxy, mail and news server, with a 64KB WAN ISDN line to Internet. In this phase the network has 5 servers (include two Sun boxes). In 1997 the LAN segmentation continued (with some segments with 100 Mbps), and the number of entry points is now 400. The network has now 10 servers (with Solaris, Linux, and NT). Table 2 summarises the network evolution.

Year	Number of entry points	Number of servers	Entry points per server
1995	170	1	170
1996	300	5	60
1997	400	10	40

Table 2: network evolution at Fernando Pessoa

An important question is the cost students have with their own notebook computers. In local Universities, the use of computers labs require a monthly fee (its cost varies from institution to institution but it is something between $22,25 and $41,50 USD).

In Fernando Pessoa the fee for using computer labs has been dropped in 1995 with the beginning of the 'notebook for all' project. The notebook minimal specifications are developed assuring that the computer price is inferior to $1625 USD (with students can pay in four years for about $2200, a value of $46 USD for month).

This means that the difference between paying services for computer labs or having their own notebook computer is just a small one, but very significant to acquiring necessary technological skills.

In table 3 the actual number of notebooks at Fernando Pessoa are shown (these figures include students and professors and are from December 1995). Note that the number of first year students have been decreased due to university policy to admissions.

Year	Students	% covered	Professors	% covered
1995	1100	25,6%	50	21,7%
1996	800	38,7%	20	28,0%
1997	400	53,5%	30	40,0%
total	2300	4500	100	250

Table 3: number of notebook computers at Fernando Pessoa

Based on the numbers in table 2 and table 3, it is possible to say that the actual infrastructure at Fernando Pessoa has a coverage of 1 entry point for each 5,75 students or 1 entry point for each 6 notebook owners. These values are even better if we consider that not all students need to be connected at the same time!

The upgrades made by students have been studied and some of the conclusions follow: the more common upgrades are related with hardware performance: memory upgrades (plus 4 MB, or 8 MB or 16 MB), an extra monitor (15'' colour SVGA monitor) and a printer (low cost inkjet or lasers).

In software, the most important upgrade is the operating system, followed by MS Office Pro. Over the project years the use of shareware and freeware has huge increase (consequence of Internet use, from none to almost 65% of total used software).

The NetLab concept

Every student can connect to the network using their own computer or through the campus facilities. Students will be able to use networked facilities, and set up projects on their area: Advertising, Marketing, Anthropology Studies, Communication, and Business on-line.

Based on the entry specification (each individual student has its own notebook computer), the introduction of computers in the university day to day has changed it dramatically. The massive presence of notebook computers now makes part of the IT infrastructure of the University. This affects in a different way the needs and the use of a Campus Wide Information System - CWIS.

As seen in figure 1, it is possible to consider the technological infrastructure just as the first layer that can enable the production, communication, change and share of content between

students, students and professors and even between professors by linking computer resources and their respective contents.

In that approach it is possible to have an experimental education lab where innovative situations can be tested. An example is the group assessment where three students make an exam: one at the classroom, another in a social location and the third in the library, each one with their functions and communicate between them using the network and its favorite computer tools (Gouveia, 1996).
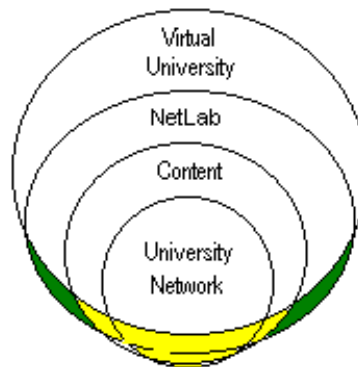

Figure 1: the NetLab concept

The system itself can be a good prototype for a local information society where different people from different courses can interact using a strong digital base for its relationship. One example could be the call for help in student's projects from subjects more related to some courses them others, or initiatives like the ecological interest group – Geonucleo - that have their own web pages (Barnatt, 1995).

One key point for NetLab is its emphasis in interpersonal communication among students, where some projects are proposed to try put people from different class and years interacting and work together. The first initiative to that was the creation of an internal IRC service (run by students) to 'put people on line' and turn the network in a live and exciting experience that deserves a daily connection just to see what happens there!

The NetLab does not intend to be a virtual campus network or a distance learning environment. It wants to be a local interaction engine that provides a structured approach to services and content generated both by students and professors.

But what is really different in NetLab and the 'notebooks for all' project?

First, it is people-centered and not technology oriented; second the entire project has a strong reinforcement of mobility; third, it provides a greater involvement between students and university by sharing of technology investments.

At last, because the network permit relocate the use of tools for information manipulation from classrooms to all spaces of the university (this bring new concepts of multidisciplinary projects; the class that never ends, new forms of interacting between students and students/professors and some more).

Internet as a 'reality resource' to use in Teaching

It's known that the society is in deep alteration, and this is a change process that although not being new, presents new characteristics: the growing speed with that the change is accomplished introducing a dynamic character and the interdependence among different activities (Oravec, 1996). In this context, the access to the information no longer is a right

but a basic need and the book itself is gradually extended by electronic supports that assure the constant update of its contents (the so-called on-line multimedia). In addiction, the know-how to use technology is being more and more commom.

The Internet supplies some tracks that point for the growing importance that the advantage of knowing how to use and what really we want to do is essential to obtain advantage of an 'information sea'. The sense of collective knowledge was never so well represented in a society as it is actually for the proliferation of the multiple sources of information. Everyday these sources are born, develop and die, in this electronic labyrinth that calls, independently of place, language, religion, age or activity million of users and hundreds of thousands of institutions.

Surprisingly, the Internet allows the search, the access, the obtaining of the information, but also the publication of information of our own responsibility. Doing that each one of the users also contributes with its creative effort to the 'information sea'; it was never so present the concept of Prosumer - the consumer that simultaneously also produces - that Alvin Toffler described in the farway year of 1980 (Toffler, 1980).

The Internet can be considered as a decentralised system, to the world scale that ties nets of computers and that uses a common protocol of communication (TCP/IP). The ownership of the computers and of each of the nets that compose the Internet belong to a great number of institutions, what reinforces its distributed character and that allows to speak in a system that reproduces without a notion of central order to govern it. The " net of the nets " as it is nicknamed, possesses actually extensive reference bibliography about many different subjects; some of this bibliography is in other languages than English and produced by local authors.

<u>Impact in the process of Teaching-learning</u>

The existence of Internet access introduces changes in the classroom and in the teacher's role. Some of the differencies and emergent effects can be listed as:

- the access to the information is facilitated: creating the potential of it picks up independently of information on an event of its geographical origin, presenting countless times multiple perspectives of a dice subject.

- the amount of available information on a certain theme is elevated: the treatment of the dropped information of the net has to obey certain approaches and even in this way the amount of information is humanly larger than it is possible to cope.

- the quality and value of the available information has to be evaluated: it fits to the user doing the evaluation of the information he assesses, because it coexists in the net good and bad information as it happens in relation to radio, to television, to the press, etc.

- the origin of the information is global: independently of the place accessed it is possible to obtain information anywhere, in different languages and besides, to obtain contacts and to question responsible people for the origin of that information.

- the knowledge of the programs and contents in national and foreign universities are accessible worldwide: this introduces enlarged and also more competitive comparison models.

- gives resources to demonstrations of concepts and services: even at national level it is already possible to discuss many themes in a practical way, consulting the information and downloading texts and software offered by other institutions.

- allows the access to texts and presentations in electronic format: this way, the production of texts can be facilitated but also they are verified with larger frequency situations of violation of author's property rights.

- access the daily information: constituting a permanent challenge of update and a difficulty of working with the 'last word' on a certain subject.

- access lists of thematic discussion: discussion groups where one can find specialists that together discuss to the exhaust certain theme; usually it is possible to obtain information of great quality and very technical.

With relationship to the impact of the Internet in the process of Teaching-learning and considering the points referred above, it is important to analyse the following issues:

- what are the possible modifications in each individual student

- what are the effects on the students assessment results

- what are the effects on the students motivation

Unquestionable is the influence that the Teacher will have in the correct use of the potentialities offered by the Internet. The students (some of them) already make it, perhaps for fashion, for curiosity, from necessity of some information or because they have free access and a notebok for it (Rossman, 1993).

It is up to to the teachers to turn the Internet from an external threath in an ally that introduces larger actuality to the class themes. It can also bring a students' larger participation and in this way to take the opportunity of finding innovative forms to use Internet in the classroom or in classroom related themes (Papert, 1993).

The experience

The experience that we want to present is the NetLab experience, where a local intranet was used to conduct most of the project supporting materials in a Web homepage for students access in order to select the most adequate elements for their projects (in and out the classrooms).

All the students can access the network via Web services at the university from Classrooms, Labs, and Library. And outside the University, via an Internet Service Provider; the way to communicate with the students was by publishing the information and wait for their individual reaction to that, based in some few basic rules. The project proposals where posted on line as the clues to use them.

The class selected is Information Systems and was chosen in order to test the potential of the intranet facilities to soften the theoretical and descriptive bias of the content subject. Also, the courses selected belong to non technical related student type, with little knowledge in the use of networks or Internet/intranet services, which where also introduced at that time.

This experiment had several goals in mind:

- training students to be more active and test their individual capacity to collect information

- force students to manage their project submissions and interact among then

- give a choice of place/time to interact with the professor and class materials

<u>Setup of the experiment</u>

One important aspect of the experience setup was its rules. They must be simple enough not to frighten students and provide a clear path of how to react to the class. The basic rules are the following:

- each student must deliver individual practical assignments and maybe request to attend a final exam using his computer.

- all the relevant information is communicated just in the class WebPages; each student must confirm everyday the information in the official Information System homepage.

- each student is the sole responsible for maintaining his notebook working and solves any problem that arises in order to fill deadlines and assignments (he can use another notebook to replace his).

- these rules are presented in the presentation day as the Information System homepage.

- all the marks obtained in assignments as all the information about the class is given just by their publication in the Information System homepage.

- any student can help another, using his notebook and the network or some computer tool but all the references to other contributions must be referended in the students work.

These six rules give the basis to the class operation, turning the notebook a necessary tool and make the browsing of the Information System homepage a everyday need. Note that the notebook must be at classroom to use and the browsing must be done in the classroom but also outside, somewhere at University or at home, via an Internet Service Provider.

One of the key goals is to introduce to students a computer tool that provides them with a clear set of functionality that can be used for dealing with information and its representation; something they understand and feel good using.

For that purposes students are introduced to Web navigation and helped on the basic preparation of their notebooks to get connected to the network, to use a browser and a mail reader. They are also introduced to what is hypertext and how to built simple HTML pages to publish. After that, students are introduced to Windows chat and to an IRC program. This has been accomplish in the first five weeks (with 4 hours/week it gives a total of 20 hours to introduce the basics).

Students practice and two practical assignments (send a mail and create their personal homepages to put in the university web server) gives the possibility to students interact among them, passing and improving their knowledge to use the notebook and the network to 'get the job done'. The students use just one tool to do these assignments - Netscape

Navigator Gold 3.0; it has the browser, the mail reader and a WebPage editor and, very important, is freely distributed (as the IRC program used).

The figure 2 is a screen shot of the Information Systems homepage. There, students can see the programme, the electronic version of supporting materials, the assignments that they must do, information and interacting procedures to speak to lectures when they need, the important dates, a news board, their remarks (including statistics, last written exams and students works).
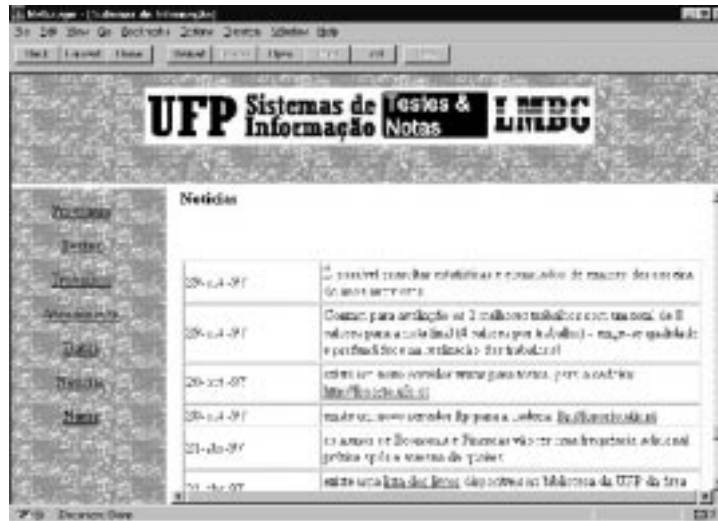

Figure 2: Information Systems class homepage

The upper menu has links to the Fernando Pessoa University WebPages (UFP), to Information Systems rules, to the exam papers and results and to the professor's homepage (LMBG).

The side menu gives links to local content like the class program, written texts and case studies, assignments, communication with the professor about information systems (email and faq), important dates, news board and class students results (exams and assignments). The display area shows the link content (in figure 2, part of the news board is seen).

The system is open to the outside world (via Web) where some questions arise like if it is legal to publish students evaluation information in web; how is author protection to material be reinforced; and what is the really impact of using this kind of service. Note that if needed it is possible to have some protection to WebPages access introduction password protection and some sort of statistical control based on counters and/or cookies.

Evaluation method

The evaluation is based in the comparison of two classes, one with network and notebooks support and another without these facilities. Both classes have the same content and a final set of questions for evaluation of what students think about Information Systems and the motivation to attend lectures.

Another item was the students marks for two different assignments (an essay about an Information Systems theme and an evaluation study for a particular information technology) and the final class result (Plowman, 1995).

The results

When asked for the services currently used, students report just five different services; they are WWW, email, irc, ftp, and chat.; table 4 presents the percent usage for the two groups studied.

Services	Experimental group	Control group
WWW	100%	28,5%
Email	57%	28,5%
IRC	100%	71,4%
FTP	28,5%	14,2%%
Chat	85,7%	28,5%

Table 4: use of communication services in the two groups

We can regroup these services as search and gather information (www and ftp; note that students usage of these services is not as publishers, for the situation reported); asynchronous communication facilities (email) and synchronous communication facilities (irc and chat) as represented in table 5.

Services	Experimental group	Control group
Gather information	64,3%	21,4%
Asynchronous com. Fac.	57%	28,5%
Synchronous com. Fac.	92,9%	50%

Table 5: services functionality usage by groups

The impact of this particular use of Intranet facilities is strong as noted in table 5 where students from the experimental group use three times more services to gather information and almost two times services that represent communication facilities (asynchronous or synchronous).

When asked if they have understood the concept of an Information System, students responded yes (4.0 in 5 for yes) the score is equivalent for the experimental and the control group.

When asked if they have learned something new in Information Systems class, students of the experimental group respond yes (4.57 in 5 for yes) against just 3,71 from the control group. It seems that the experimental group has benefited from the use of Intranet enabling class.

When asked if they have to define the subject as a practical one or theoretical, students of the experimental group respond 2,1 (5 for theoretical) against 3,71 from the control group.

When asked if they think the 4 hour/week for the class is adequate, students of the experimental group respond 4,2 (5 for yes) against 2,1 (little time) from the control group.

When asked for the importance of the class to their future professional life, students of the experimental group respond 4,6 (5 for yes) against 3,2 from the control group.

When asked for the relevance of the Information Systems homepage, students of the experimental group respond 4,0 (5 for yes) against 4,57 from the control group. It seems

that the experimental group became more aware of the information they can gather from these pages against other web resources.

The results for the experimental group represent a 75% of approvals while in the control group this value is just 65,5%. Also the average mark in the experimental group is 14,6 in 20 while for the control group has an average of 13,2 in 20.

Students involvement has been higher (experimental group) than the one from other equivalent classes. Also, it created expectations for the use of their notebooks in other University context from the simple use of Intranet to the use of hypertext as a better way to answer exams and make project proposals.

As a result of using Intranet facilities students tend to classify their work in Information Systems as a practical one and to discuss concepts in a deeper way, comparing with other similar classes where these experiments aren't done. Also, they found new forms to interact between them and with the staff.

These experiment has also some effect in the way students see their notebook computers, since they invest in memory upgrades to get the most of their computers and start to incorporate them in their activity as students, improving their ability to incorporate computers in their response to schools activities. It is possible to say they become more aware of the technology, with this student group investing more on buying external monitors to use with their notebooks and printers to gain independence from university services (two times more cases in the experimental group: 42% against 19,8%).

Conclusions

These experiments bring Internet use to support classes. As seen, an important way to get students involvement is to make them build their own representation of the concepts and content introduced in Information Systems by creating a practical and electronic environment – can it be used in other classes?

Some results even demonstrate the possibility to introduce more complex use of technology in 15 weeks classes. Based on the use of notebook computers that gives the students the possibility to continue work outside the classroom: this gives the idea of a 'never ending class' with an impact that deserves further study (this idea can be explored by putting some questions: is it good? Can students cope with more simultaneous classes using the same concept? Can this really introduce better content understanding?).

More ambitious thoughts can be draw by redefining University as a education lab without physical boundaries like the classrooms walls or even harness the use of a virtual space to information interchange between net users that offer a living organism of ideas and regular meeting (Gouveia, 1996), (Harris, 1996).

Seeing the technology as human facilitators is, perhaps, the best bet as Pavel Curtis says, "The killer application of the 90s is people" what gives to technology like computers and networks just secondary roles in the global process of education.

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