PROJECT INTERNET CATALONIA (PIC)

UNIVERSITY AND THE NETWORK SOCIETY

Use of the Internet in the higher education system of Catalonia

Summary of the final research report

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Generalitat de Catalunya

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Foreword

The summary that follows contains the results of the research conducted with the general aim of analysing use of the Internet by the academic community (students and teaching staff) of the university system of Catalonia. When we say “use of the Internet” by the university community, we refer to everyday use of the Net (access, activities, change in habits, etc.), but also to use of the Internet in teaching and learning processes.

This study forms part of the PIC or Projecte Internet Catalunya (Catalonia Internet Project). It is based on the work of diverse contributions from subgroups of this research project[1] and on early contributions to research on the Internet society in Catalonia (Castells, Tubella, Sancho, Díaz, Wellman, 2003).

There are many studies on use of the Internet by the general population, published each year by different institutions and organisations specialising[2] in the analysis of the information society (such as AIMC, in Spain). However, this is not true of research specifically on use of the Internet by the university community. Some state and international organisations and even some research groups have taken a general look at use of the Internet by universities (Barro & Burillo, 2006; EURYDICE, 2002; Pazos & Franco, 2004; Van Vught, Bartelse, Bohmert, Burquel, Divis, Huisman & Van der Wende, 2005), though often using a blanket approach with qualitative methodologies, case studies or databases that are neither big nor significant enough. Studies on Internet use in education are indeed few and far between. Apart from PIC Escoles (Mominó, Sigalés, Fornieles, Guasch & Espasa, 2005), which analyses use of the Internet in non-university education and forms part of this wider research group, there are no studies with sufficient data to accurately analyse its use in the university community for educational purposes.

This research uses an ambitious and far-reaching design. It is ambitious in the sense that it has tried to obtain the data required to analyse the university system of Catalonia both globally and specifically, university by university if necessary. And it is far-reaching because it studies not only the non-academic use of the Internet by the university community (students and teaching staff), but also academic use, and it has related the two to come up with significant associations that explain certain actions and results. It also analyses elements such as use of Internet in research or use of university libraries.

To conduct the research that we now describe, we have used different research methodologies that complement one another, as we explain in Chapter One of this report. Firstly, we

1. http://www.uoc.edu/in3/pic/
2. Oxford University’s Oxford Internet Institute, one of the leading research centres on the topic.

designed and applied a wide-ranging questionnaire, which was sent by e-mail directly to students and teaching staff of the public universities and the distance-education university. Thus, we designed an authenticated questionnaire that would allow us to analyse the data by the different origins of respondents. The use of this quantitative methodology led the research group to debate the formulas required to obtain a significant study population sample. This was achieved in practice (the error margins are around 0.66% for students and 1.95% for teaching staff), so we have obtained a very significant sample of the university community of Catalonia.

As we explained above, the purpose of this study was to analyse the educational and non-educational uses of the Internet by students and teachers. As a research group, we chose to apply the questionnaire by e-mail, given that our analysis would be based on the answers of Internet users and not of those who do not use the Internet. This research does not deal with the reasons or decisions for a possible, though probably non-existent, group of students and teaching staff in Catalonia who still do not use the Internet.

The research team also opted to complement the raw quantitative data with a qualitative research project based on 52 in-depth interviews with members of the academic and institutional staff of each university studied. The purpose of these interviews was to gain an awareness of the institutional situation of each of the universities analysed and to observe global trends in the system. Lastly, as explained in the chapter on methodology of this report, we have complemented this data with a set of indicators on infrastructure and institutional services involving use of the Internet in universities.

This summary in English describes the interim results obtained basically by analysing the data from the on-line questionnaire sent to students and teaching staff. We have complemented some of these contributions with elements from the interviews. Thus, we reiterate here that this is the summary of an interim report, of which diverse partial and specific reports will be prepared so that we can work dynamically with the data obtained from the different methodologies.

This study shows the aggregate data for the entire system, i.e. it does not present individual data for the eight universities that took part and nor does it conduct comparative analyses between them. For obvious methodological reasons, there are some exceptions to this, such as when we analyse areas where it is necessary to separate the students or teaching staff of the system's distance university, which operates exclusively on-line. The profile of students at this type of university is different to that of the rest because they are older and almost all have jobs as well as prior experience in on-line learning. Teaching staff at these universities are already experienced in using the Internet for educational purposes, particularly on-line teaching.

The research hypotheses are described and dealt with in the various chapters of this report. They are all independent of each other and discuss an area of the research we have conducted. Nonetheless, they all have cross-sectional dynamics allowing us to pinpoint relationships between those put forward initially, which are confirmed or disproved in the conclusions of each chapter and in the overall conclusions at the end of this report.

The conceptual framework of the research is the relationship between the Internet society – Societat Xarxa (Castells, 2000), education systems and teaching with the use of technology (Cabero, 2006; Collis & Moonen, 2001; Duart & Sangrà, 2000; Pedró, 2001; Tiffin & Rajasingham, 2003). We are therefore interested in studying this relationship within the context of the system, in this case, higher education in Catalonia.

We have organised the summary into several sections, which we will now describe.

Chapter One describes the design and methodology of our research. Some of the details and strategic and methodological decisions that have shaped this research are explained above. This chapter presents the main aims of the research, the research hypotheses and questions and the proposed methodologies and tools. It also includes the schedule for conducting the research.

Given the importance of the quantitative methodology of this research, we have considered it appropriate to include a chapter showing how we obtained our sample. The methodology used is also innovative for this type of study. We have not used an initial sample; instead, we took the tool that we were studying – the Internet – and used it to distribute our survey among the target population, subsequently generating a significant sample that we could work with. The way we did this and the methodological decisions we took are described in Chapter Three of the report.

We present and analyse the results in Part 3, which contains the most relevant conclusions for each of the areas that we divided the research into in the original report. Hence, the summary of the results contains the following sections:

- Use of the Internet for non-educational purposes by students and teaching staff. This chapter, like the others, deals with students and teaching staff separately and analyses three areas relevant to the analysis of Internet use. Firstly, it analyses the data obtained on the Internet access of students and teaching staff. We show when, how, from where and how long they connect, sketching out a global profile of access for each group. Secondly, we analyse their expertise and the expansiveness of their Internet use. We indicate the level of Internet skills and expertise of the two groups and how these expand into everyday activities, such as using

the Internet to find out information, shop, download music, chat, etc. The result is a categorisation of uses and profiles, from greatest to least expansiveness, that generate relevant results when cross-referenced with socio-demographic data like gender and age, among others. Lastly, this chapter analyses the impact of Internet use on the day-to-day lives of students and teaching staff. This part of the chapter was written up in coordination with that on communication of the PIC reports. Although the results of students and teaching staff are always dealt with separately, comparisons of the results of the two groups are made throughout this and subsequent chapters.

- Use of the Internet in universities for educational purposes, i.e. using the Net for teaching and learning. This chapter begins with a section indicating the experience of students and teaching staff in using the Net as part of the teaching and learning processes. Use of the Internet for education purposes is assessed separately for students and teaching staff and then a comparison is made between them to establish the readiness for using this technological tool in higher education. The third part of the chapter analyses real Internet use, i.e. the actual use made by the groups studied and their experience. It evaluates issues such as whether the Internet is used to research and write up academic work or for classroom preparation, and the use of specific tools like forums, chat rooms, blogs, etc. This section is extremely important because it tells us about the real experience of the two groups. A contextual analysis is then made of institutional models of Internet use for educational purposes before two methods of education that use technology are analysed separately: the hybrid method and the on-line method. The hybrid method combines classroom teaching with distance education via the Internet, while the on-line method uses the Internet intensively and is therefore carried out completely by distance. For the latter method, students at the on-line distance university of the education system were analysed, in some cases with students from other universities who have experience of this method. The analysis of these methods evaluates aspects such as interactivity, degree of tailoring and flexibility of the learning process, autonomy, time management, etc. It also compares the methods to establish their likenesses and differences. Lastly, the technique of grouping variables and individuals is used to determine behavioural styles and user profiles.
- The relationship between the diverse uses analysed thus far (academic and non-academic) and the academic performance of students. A number of statistical techniques were used for this purpose, including bivariate analysis and logistic regression models. In this context, our model considered other student profile variables of a more socio-economic and demographic nature, which the specialist literature has shown to be important in explaining academic performance. From this perspective, then, we discovered that technological variables are another piece in the jigsaw puzzle explaining the relationship between study variables and academic performance.

- The relationship between Internet use and research. This chapter basically analyses data on teaching staff. Aspects such as use of the Internet specifically for research, whether by individuals or as part of a research group, for cooperative and international research work, for disseminating research and for publishing it on the Net.
- The relationship between Internet use and use of university libraries by both students and teaching staff. The purpose of this chapter is to offer an insight into the extent to which on-line search engines are taking over the basic functions of libraries in universities. It also evaluates the current situation of libraries and how they have adapted and continue to adapt to this new situation of accessibility and visibility of information on-line. This chapter uses the contents of the interviews as well as the answers to the questions asked in the questionnaire.
- Lastly, it discusses the level of entrepreneurism among students and teaching staff of the system. In our case, we take entrepreneurism to mean the future desire to set up a company or, in the case of teaching staff, to have already done so or be thinking of doing so. The aim of this chapter is to indicate the degree of entrepreneurism in the group analysed by comparing the results with those of research conducted in Catalonia and other EU countries.

Despite this thematic and sequential structure, all of the chapters in this report cross-reference and analyse variables from others, rather than dealing with them in isolation. For example, they take into account the results on Internet expertise when discussing teaching experience or the use of libraries in relation to guidelines for finding information for projects on the Internet.

The last part of this summary presents the overall conclusions of the research and suggests some possible causes for the results obtained and the confirmation of the hypotheses. Nonetheless, each chapter draws its own conclusions from the contents analysed therein.

It is important to remember that this report deals with the interim or preliminary results of the research. It opens the door to many analytical possibilities for the data obtained, some of which are already being studied, such as the relationship between these data and student performance or specific analysis of the qualitative part of this research. With this project, the research team wished to highlight the Internet's potential to introduce change into the higher education system and the need for institutional involvement to achieve it. In this regard, the analysis of the university system of Catalonia has provided us with key information.

Part 1

Design of the research

1.1. Introduction

The development of the information and communication technologies (ICTs) over the last 40 years of the twentieth century and their incorporation into the various areas of our activity have led us to ask ourselves, now, in the early twenty-first century, what the major changes have been that have accompanied this irruption and what their consequences are, at least in the short term.

Projecte Internet Catalunya (PIC) was born out of a project commissioned by the President of the Generalitat of Catalonia to Professor Manuel Castells in June 2001. To carry out the project, a team of UOC researchers was organised under the joint supervision of Professor Castells and Imma Tubella. PIC is an interdisciplinary research programme on the information society in Catalonia conducted by researchers from the Internet Interdisciplinary Institute (IN3) of the Universitat Oberta de Catalunya (UOC). Its main aim is to determine the technological and organisational changes that have taken place in diverse areas of Catalan society, economy and institutions. In the framework of the former DURSI (Ministry of Universities, Research and the Information Society), this general programme is now embarking on a second phase concerning Catalan universities that plans to consolidate the lines of investigation begun in earlier projects of the same programme.

1.1.1. Background

In this context, the direct predecessor of this research was the “Internet i la xarxa d’universitats catalanes” (Internet and the Catalan Universities Network) project, conducted between 2002 and 2004 in the framework of the PIC. This project began with a global investigation of the incorporation of the Internet into Catalan universities and analysed the processes of change introduced by the latter that affected education and research at Rovira i Virgili University (URV). The report was published on the UOC website in April 2004 (http://www.uoc.edu/in3/pic/cat/universitat_xarxa.html) and presents the results of three studies, each of which had its own aims and methodology:

- Configuration of the network of universities in Catalonia: physical connection and joint projects.
- Presence of Catalan universities on the Internet.
- Case study: the URV.

1.1.2. Conceptual map

Although we had access to the work from the first phase of the PIC, there remained a great deal of ground to cover because we had to be very clear about the aims of this project and

where we could find the information to achieve these aims. It was clear that there were many aspects that we would need to ask students, teaching staff, vice chancellors and/or heads of different organisations in the universities directly. It was also necessary to decide how we would do all of this and how we would organise the information obtained. Hence, we designed a conceptual map,[3] which we later found very useful for defining the project aims and is basically a series of different tools:

- Socio-demographic information that could be used later to establish individual profiles.
- Aspects reflecting how the Internet is used by the Catalan university community in general.
- Aspects that indicate whether changes have taken place in the teaching/learning process as a result of the large-scale introduction of the Internet in our society.
- Changes that have taken place in university libraries, in the publications service and among administrative and services staff (PAS).
- Repercussions on IT services and technological infrastructures.
- Effects of the incursion of the Internet on sources of university funding, teaching innovation, research and teaching.

3. See Appendix (http://uoc.edu/in3/pic/cat/universitat_societat_xarxa/informe.html)

1.2. Aims

The main aim of the project is to identify and analyse use of the Internet by the university community of Catalonia, particularly for educational purposes. Hence, its object is to determine the intensity of Internet use in education and social relations, to discover why it is used and to mark its main milestones and most relevant difficulties. In this respect, it would also be an interesting exercise to observe the extent to which the Internet has helped to create a new configuration of universities in Catalonia.

On the one hand, we analyse all levels of use of the effective incorporation of the Internet into Catalan universities and how this incorporation has changed their educational, social and management structures. And on the other, we study the repercussions of the changes that have taken place within universities on Catalan society in general.

Working from the premise that the incorporation and use of telematic tools in the diverse areas of university life is a fact, our study focuses on the level of implementation of the Internet and its different uses by the university community in any area of the academic sphere in Catalonia. In other words, we study Internet use by taking into account the different users, diverse styles and intensities of use and the flexibility of the academic and administrative structures in incorporating telematic tools into their day-to-day development. Thus, we explain the processes of change that have taken place in universities and identify the most relevant factors involved.

In this approach, the project is organised into four main blocks:

– *Internet use*. Pinpointing and assessing the different uses of the Internet by the university community in the various areas of the university system of Catalonia.
  - Types of use.
  - Intensity of use.
– *Implementation of the Internet*. Determining the extension of the Internet tool in Catalan universities as a whole, from the point of view of the extension of physical infrastructures and from its institutional implementation.
  - Evolution of technological infrastructures.
  - Volume and quality of the implementation of the Internet in Catalan universities as a whole.
– *Changes in teaching and learning processes*. Observation of the changes that the Internet has had on the design, planning, development and assessment of university teaching.

- Evolution of the incorporation of ICTs in teaching.
- Changes in teaching models.
- Changes in study and research habits.
- Developments and resistance.

– *Practices and policy of the department for universities of the Catalan Government and of Catalan universities as a whole in matters concerning the promotion and diffusion of Internet use*. Assessment of guidelines from the government administration of Catalan universities and the flow of on-line communication between the latter and the university system.

- Evolution of policies to promote ICTs in Catalan universities
- Strategic planning and institutional initiatives in processes to integrate technology.

1.3. Methodology

For the empirical study, an in-depth study was conducted on a representative sample of each public university of Catalonia: the Autonomous University of Barcelona (UAB), the University of Barcelona (UB), the University of Girona (UdG), the University of Lleida (UdL), the Polytechnic University of Catalonia (UPC), the Pompeu Fabra University (UPF) and the Rovira i Virgili University (URV). The Open University of Catalonia (UOC) was also included in the study.

The investigation combines typical quantitative research tools with qualitative ones in order to produce the synergies associated with mixed research. For gathering information on university groups and their use of new technologies, we chose an electronic survey as our data collection tool. The main advantage of this is that it can be sent, received and answered by e-mail. Our survey was sent through the DURSI to the various Catalan universities analysed in this research, so that it could be answered by a representative sample of students and teaching staff at each of the universities.

For the qualitative aspect of our research, a number of interviews, both exploratory and in-depth, were held on all aspects of university life with key informants. The interviewees were people who have a direct relationship with teaching – students and teaching staff – and staff who work in the administrative management of the universities. The opinions of members of the governing bodies of the universities were also taken into account in an attempt to understand the policies and planning of technological integration at the university. Lastly, contact was made with the cross-sectional services that enable or support the teaching process, such as IT departments.

This second line of research, by nature, required each university to appoint one or more individuals as spokespersons to facilitate the selection of and contact with interviewees and other individuals who could provide the documentation needed for the research, based on a detailed list of proposed actions drawn up by the UOC research team.

1.3.1. Design of data collection tools

To conduct the study correctly, information was collected on three different areas. Firstly, it was essential to obtain general data on the university system of Catalonia. Secondly, it was necessary to conduct a study on use of the Internet by the university community. And lastly, we had to have a clear idea of the policies and practices of universities to foster the integration of the Internet within the university community.

a) *General data on the university system of Catalonia*

To contextualise the study, we needed some basic data to describe the university being studied.

1. Background to the introduction of the Internet in the university:

- Documentation on the process.
- Interviews:
  - With any individual with a historical and general knowledge of the incorporation of the Internet into the university.
  - With any individual from the university's IT department.
  - With the head librarian.
  - With the head of the ICE (Institute of Education Sciences) and/or resources centre.

2. Descriptive quantitative data:

- Collection of data published in the annual reports of the university (for each academic year since the university began its academic activity).

3. Quantitative data on the functioning of the various Internet initiatives carried out by the university:

- Collection of data allowing us to assess the significance of these initiatives.

4. Quantitative data on performance:

- Collection of data published in the annual reports of the university (for each academic year since the university began its academic activity).

b) *Study of Internet use in the university community*

1. Use of ICTs – and the Internet in particular – in the public university system of Catalonia: Description of current Internet use.

- Questionnaire-based survey:
  - Quantitative data on Internet use over time, level of computer and Internet expertise, connection frequency and duration of sessions.

  - Data on Internet monitoring and security.

2. On-line education: description of the characteristics of educational activities conducted over the Internet.

- Documentation on on-line education.
- Quantitative data on the range of educational activities carried out on-line, monitoring and student satisfaction.
- In-depth interviews with individuals with a weight in making decisions on this type of educational option.
  - With faculty deans, directors of schools or directors of studies.
  - Heads of subjects.

3. Analysis of on-line services offered by universities to their communities and analysis of the use of the Internet in the academic and administrative management of universities: description of the on-line services offered to students and teaching and services staff by universities. Overview of use of the Internet in the administrative management of universities.

- Catalogue of available on-line services (academic and management).
- Data on the use of these services.
- Evolution of services and their use by groups (teaching staff, students and PAS).
- Interviews with heads of services.

4. Overview of teaching staff: to find out the intensity of Internet use in tasks related to the teaching of students and to determine the organisational changes brought in by the incorporation of the Internet at departmental level. The study also hopes to identify the changes in the research habits of university teaching staff brought about by the introduction of the Internet.

- Documentation on the use of the Internet in teaching activities.
- Applications and resources for on-line teaching.
- Interviews with teaching staff who use the Internet to different degrees in their teaching.
- Questionnaire-based survey.
  - Use of the Internet for preparing and giving classes.
  - Experience of semi-distance and on-line courses.
  - Use of the Internet in the classroom.

5. Overview of students: to find out the type and intensity of Internet use in their learning process and day-to-day development at university, mainly in terms of the changes that the Internet has had on their study habits.

- Questionnaire-based survey.
  - Use of the Internet in learning styles.
  - The role of hypertextual logic in the learning process.
  - Experience of semi-distance and on-line courses.
  - Use of the Internet in the classroom.
  - Reliability and rigour on the Internet.
- Discussion groups.

6. Analysis of on-line university community activity: observation and analysis of the activities carried out on-line by groups or communities set up at universities and the relations established between them.

- Description of the Internet-based university communities at the different universities. Evolution and uses of the Internet.
- Observation of behaviour and levels of Internet use through analysis of their spaces.
- Observation of relations between university communities.
- Design of a map of relations based on interests and uses.
- Behavioural analysis of these relations.

1.3.2. Data collection and processing

To collect the data for the research, we designed the procedure in conjunction with the Comissionat d'Universitats (Commissioner of Universities). For the quantitative research described above, we required the NIF (Tax ID number) and e-mail address of all students and teaching and research staff of each of the public universities studied. The survey was then sent to the e-mail address provided.

By cross-referencing the NIF data with those of the CUR in its data warehouse – UNEIX – we established the section of the study population on which the CUR has additional information. Once we obtained all the survey responses, the matrix of answers could be fed from the data obtained from the CUR databases – both that containing the information supplied

to the CUR each year by universities and that containing the information collected each year during the university enrolment process (see appendices) – in order to produce relevant user profiles and establish significant correlations for developing our research. Naturally, as is always the case, the final research results will be presented on aggregate and never individually.

1.3.3. Schedule

The planned schedule for the various phases of the project is indicated in Table 1.1:

Table 1.1. Planned schedule of the project

	Start	End
Preliminaries, start and preparation of the project	March 2005	April 2005
Contacts and definition of the project details with the universities and the DURSI	April 2005	June 2005
Interviews and analyses of participating institutions	June 2005	April 2006
Design of the questionnaire	June 2005	December 2005
Data collection	April 2006	June 2006
Investigation and data analysis	September 2006	February 2006
Feedback from participating institutions	September 2006	November 2006
Drafting and dissemination of report	February 2006	June 2007

Source: Own work

Data collection includes the questionnaire-based survey, the interviews and the discussion groups as well as the collection and storage of documents. The table below indicates the timetable of this phase in more detail:

Table 1.2. Schedule of the data collection phase

	Start	End
On-line questionnaire Company selection Sample design Creation of the questionnaire Administration of the questionnaire Construction of the data matrix	 November 2005 May 2005 June 2005 April 2006	 December 2005 February 2006 April 2006
Interviews Vice chancellors Interviews with key informants/discussion groups	April 2005 June 2005 December 2005	July 2006

Source: Own work

1.3.4. On-line survey

This project included an electronic survey for all enrolled students and teaching staff of Catalan public universities in the 2005/2006 academic year.[4] Nonetheless, because a virtual university was included and certain aspects did not apply to its students and teaching staff, four different questionnaires were sent out: two for students, virtual and classroom-based, and two for teaching staff, virtual and classroom-based.

a) *The on-line survey as the optimum method of collating information*

Although many specialists in this area question the reliability and validity of Internet surveys, we believed it appropriate to use one for collecting quantitative data on students and teaching staff of the public university system of Catalonia. Since our aim lay in collecting data on the Internet, use of an on-line survey gave added reliability to the information obtained, since the profile of the individual responding to the survey had a series of very unique features: firstly, they made extensive use of the Internet and, secondly, they had an active institutional e-mail address. We should also point out that those who answered did so freely and had been prepared to fill in a questionnaire in which many of the questions were compulsory. Hence, we believe that this was a valid and reliable tool for gauging the impact of the Internet on the Catalan university community.[5]

There are, nonetheless, a number of relevant aspects explaining the advantages of an on-line survey. Firstly, an identified or non-anonymous survey was used. This meant that it was possible to add to the information obtained from the on-line survey with the DURSI databases. This also enabled us to use a shorter questionnaire focusing on the aspects on which there is a real shortage of information, i.e. those most closely related to the use and frequency of use of new technologies in Catalan universities.

Secondly, the questionnaire was sent to the whole population. A study population sample is usually extracted from surveys conducted by post or telephone for two main reasons: one realistic and the other, economic. However, it is very difficult to reach the entire population because the information available is very often obsolete or not entirely correct. In addition, the cost of contacting the person is very high. Hence, it is necessary to obtain a sample small enough not to require large amounts of financial resources but which, at the same time, will guarantee the representativeness of the population. With our project, though, instead of

4. See technical data sheet in appendix (http://uoc.edu/in3/pic/cat/universitat_societat_xarxa/informe.html)
5. See the appendix for a copy of the questionnaire (http://uoc.edu/in3/pic/cat/universitat_societat_xarxa/informe.html)

a priori sampling to obtain a representative sample to whom we could send the survey, we decided to act at census level and send the survey to all students and teaching staff at the Catalan universities studied. This gave us a larger sample that considerably reduced sampling error and virtually eliminated systematic errors associated with survey validity bias.

b) *Theoretical sample of the Catalan university population*

Initially, for a rough idea of the number of surveys required for each segment (students and teaching staff) of the universities studied, we calculated a theoretical sample.

To obtain this sample, we assumed a number of aspects:

- Sampling error, or maximum permitted difference between the estimate of a parameter and its true value, of 2%. Hence, we considered the usual 5% to be too flexible a hypothesis for a study of this scope.
- Confidence interval, or likelihood that the estimate reflects the reality, of 95%.
- 50% of the population, based on the premise that we are working with a homogeneous population.

Table 1.3 contains the results of these theoretical samples for students and teaching staff at the Catalan universities analysed. In this way, we were able to control the number of replies required to obtain results that were as close a reflection of the reality as possible.

Table 1.3. Representative sample of students and teaching staff in the public university system of Catalonia

University	Students		Teaching staff	
	Population	Sample	Population	Sample
UAB	32.012	2.233	3.082	1.350
UB	49.657	2.290	4.265	1.536
UdG	10.161	1.942	973	693
UdL	7.795	1.836	743	568
UOC	23.811	2.181	850	628
UPC	27.907	2.211	2.500	1.225
UPF	8.217	1.858	885	647
URV	11.435	1.984	1.250	822
TOTAL	170.995	2.368	14.548	2.061

Maximum permitted difference: 0.02; confidence: 0.95; Proportion of the population: 0.5.
Source: Own work

c) *Effective sample and representativeness of the sample obtained*

A few weeks after sending the surveys, we confirmed that our decision to send them to the entire population had been correct and that we would obtain more reliable results than envisaged. Moreover, in order to increase the number of answers, in the event of obtaining major differences (sampling error), we decided to re-send the survey to those who had not begun to answer it, as a reminder. In doing so, we excluded individuals who had given up and those who had completed the questionnaire. A control was carried out on the samples and their corresponding errors when there were still a few weeks remaining before the survey ended and the influx of replies generated by the reminders was cut off. Table 1.4 contains the final samples and level of accuracy for each university.

Table 1.4. Effective sample and sampling errors of students and teaching staff at each of the different Catalan universities

University	Students		Teaching staff	
	Sample	Accuracy level	Sample	Accuracy level
UAB	3.756	1.50%	470	4.16%
UB	6.127	1.17%	672	3.47%
UdG	1.252	2.59%	138	7.75%
UdL	724	3.47%	75	10.74%
UOC	2.625	1.80%	95	9.48%
UPC	3.076	1.67%	390	4.56%
UPF	855	3.17%	88	9.92%
URV	1.137	2.76%	221	5.98%
TOTAL	19.552	0.66%	2.149	1.95%

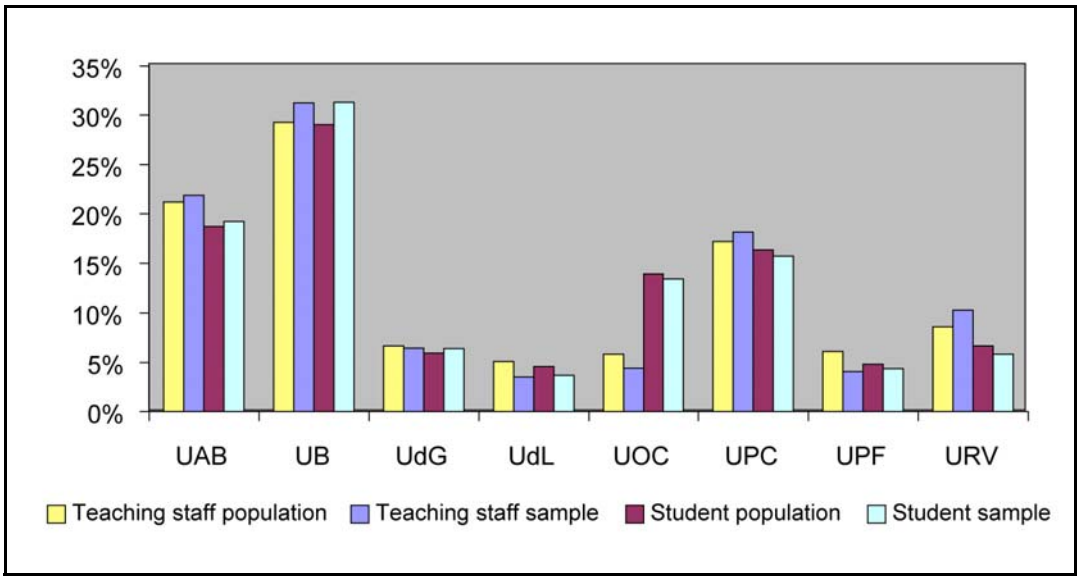
Source: Own work

As we can see, many of the sampling errors obtained for students are under 2%. However, these errors reach considerably higher values for teaching staff, in some cases exceeding 10% (teaching staff at the URV, UPF and UdL). However, the overall differences for this sample are under 0.6%, both for the student segment and in the aggregate, unsegmented results, and under 2% for teaching staff.

Given the importance of respecting population proportions in order to obtain a representative sample of the universe studied in Figure 1.1, we compared the percentage of universities in our sample with those of the university system of Catalonia. We can see that the differences between the first two bars of each university, representing teaching staff, are very small. The same is true of the last two bars, which illustrate the proportions of students for the population and the sample.

In this context, we need only point out that, although the fifth university with the greatest number of enrolled students for the population is the URV and the sixth is the UdG, these positions are reversed in our sample. The same occurs with teaching staff and the proportions representing the UPF and the UOC for all university teaching staff.

Figure 1.1. Comparison between the percentage of universities in our sample with those of the university system of Catalonia.



Source: CUR, UOC and own work.

To be able to use this data, the essential initial univariate descriptive analysis was conducted in order to obtain a static photograph of the public university system of Catalonia (Greene (2003), Wooldridge (2002), Cameron & Trivedi (2005)). Following this, we used contingency tables (Guajrati, 2006) and correlation analysis to analyse all possible relations between the various aspects dealt with in the survey, which helped both to create new variables that could be used later in more advanced statistical models and to determine profiles. In this context, we applied different multivariate techniques to cut down the information (Hair et al., 2000), including multiple correspondence analysis (Greenacre, 1984), to attempt to group together different aspects in diverse variables, and cluster analysis (Rumesburg, 2004), to group together individuals with similar characteristics. To sum up – and as the final conclusion to the two main chapters of this report – we have extracted profiles of individuals that fully confirm the bivariate analysis conducted previously.

1.3.5. Interviews

To obtain qualitative information to extend and delineate the information obtained through the other techniques used in this research (questionnaires and indicators), we decided to

host a series of in-depth semi-guided interviews, which were transcribed and their contents analysed for subsequent use.

The process for obtaining access began with initial first contact with a representative of the DURSI, who provided eight contacts, one for each university, each of whom identified and facilitated contact with the most appropriate individuals for obtaining information in six areas of the university:

- Teaching and innovation in education.
- Research.
- Libraries.
- PAS.
- IT services.
- Website and communication.

From these interviews, which totalled 52 in the end, we collected information on the policies and strategies used by Catalan universities for ICTs in particular, both currently and in the past. To do so, we addressed individuals with a knowledge of these events, particularly vice chancellors and heads of service of the universities studied. However, besides this information on institutional policy obtained from the interviews, we also requested information in the survey to delineate the results and try to find out certain clues to explain the data, which is one of the strong points of qualitative research.[6]

1.3.6. Indicators for assessing the use of ICTs in universities

In the framework of this project and in order to provide an objective assessment of the level of ICT use in Catalan universities, we established a number of indicators. These fall into the conceptual framework of Figure 1.2.

Universities carry out their activity in a socio-economic context in a given geographical area, where they exert their most direct influence. This context generates a series of general features applicable to the whole system and others that are specific to each university. The development of the human capital associated with the university, competitiveness and

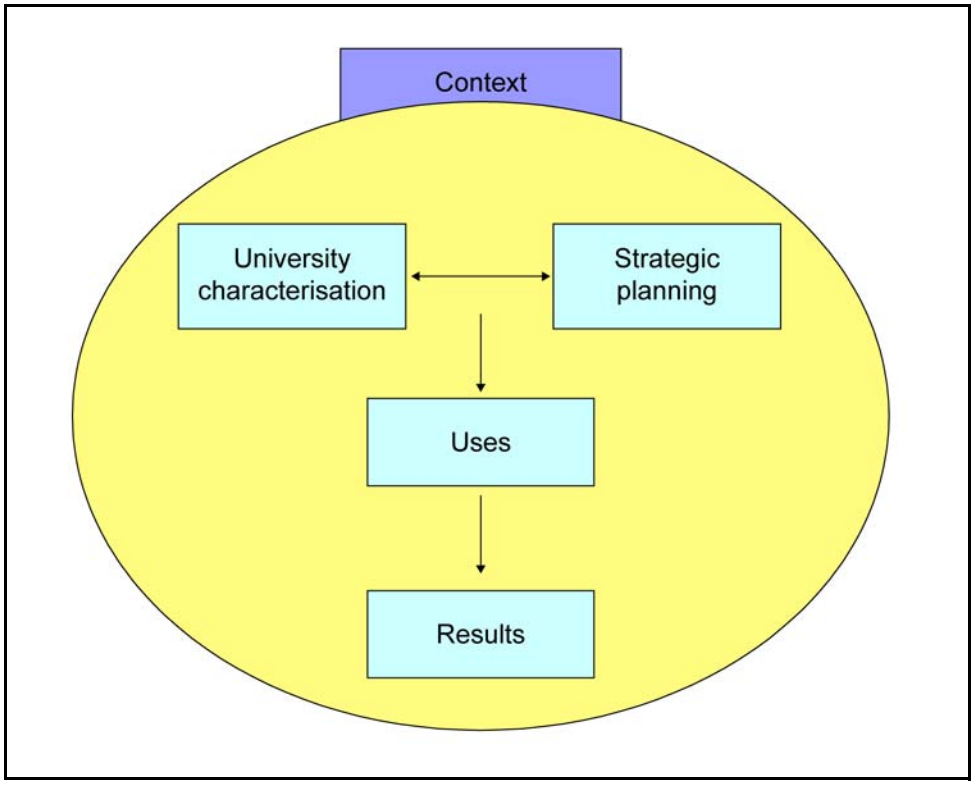
6. See appendix for transcribed text of interviews.

cooperation with the leading agents of its environment, etc., determine and define its social mission.

Figure 1.2 also illustrates how the characterisation of each university in relation to its strategic planning determines its specific use of ICTs in its processes, be they academic and/or management, which explains the results that we expected and obtained. Thus, the fact that a university is characterised as technological, general or distance naturally conditions its strategic planning and use of ICTs. The same is true of its relations with the government.

The use of ICTs is, in turn, related to elements of infrastructure, financial aspects and, in the most specific case of teaching processes, to policies incentivising or fostering innovation.

Figure 1.2. Conceptual framework of the Indicators of use of ICTs in universities



Source: Own work

Based on Figure 1.2, we developed a series of indicators that can be divided into seven main blocks, which we will now describe. Each block contains different indicators and sub-indicators at different levels (dichotomic, open, etc).[7]

7. See the appendix for a copy of the indicators questionnaire (http://www.uoc.edu/in3/pic/cat/universitat_societat_xarxa/informe.html)

a) *Policy and strategic planning indicators*

This block of indicators contains those referring to whether or not specific strategic planning is in place for the use of ICTs in the university and whether or not there is an assessment system for strategic planning.

We consider relevant the analysis of the development of strategic plans on the use of ICTs, particularly those for monitoring and assessment of the latter. University institutions often fail to plan the introduction of ICTs adequately (Duart, Lupiáñez, 2004) and this conditions their results and raises questions about the effectiveness of their investment policy in technology infrastructures. With this project, we try to analyse the existence of an increasingly visible culture of strategic planning and acceptance of the culture of assessing it.

b) *ICT expenditure and investment indicators*

The aim of this section is to analyse the expenditure and investment in ICTs by universities. We also evaluate the evolution of these expenses and the different sections of the ICTs to which they refer. We are also extremely interested in analysing the volume of expenditure on teaching innovation, which is an element to take into account when assessing institutional support to the latter.

c) *Technology infrastructure indicators*

The volume of computers available to the university community and the volume of classrooms and mobile computing devices are some of the basic indicators in this block. Intranets for education purposes, wireless access, etc. also form part of it. We know that ICTs cannot be used correctly without the right technology infrastructures. The aim of this block, therefore, is to analyse and evaluate not only whether they belong to an infrastructure, but also – and very importantly – to determine whether their evolution is sustainable.

d) *Indicators of teaching processes that use ICTs*

One of our main aims is to observe the use of ICTs in teaching and learning processes, hence the need to establish a specific block of indicators to cover this observation. The object of our analyses is the volume of subjects and their typologies in the syllabuses offered in some of the possible formats of ICT use.

With this block, it is also important to analyse the training of teaching staff in the use of ICTs and the human resources available to provide the necessary support for the development of subjects and courses that have an intensive ICT use.

e) *Indicators of research and use of ICTs*

It is clear that ICTs and particularly the Internet are commonly used in research processes, whether to find information, to disseminate results or for communication between researchers. Our project basically attempts to analyse use of the Internet by on-line teams, not only in terms of research, but also the group's on-line presence and use of the Internet as a means of communication and tool for asynchronous group work.

f) *Indicators of systems for accessing information (libraries) and digital publication services*

Libraries have played a fundamental role in the introduction and use of ICTs in universities (Duart, Lupiáñez, 2004). This block of indicators analyses the technological equipment of libraries and their digital collections. Databases and accesses to the digital collections of libraries are essential in policies to introduce ICTs to educational processes and for research support. We are particularly interested in the level of use of libraries and their collections to evaluate their impact as a platform for accessing information by the university community.

The visibility of academic and scientific production is another of the elements to analyse in this block of indicators.

g) *Indicators of academic and administrative services*

Lastly, there is also a block of indicators formed by elements on the use of ICTs in administrative and academic services. We are interested in observing and analysing the volume and types of services offered to the university community by higher education institutions. It is also interesting to observe the use of these services by students and teaching staff and chart their evolution into the use of mobile devices.

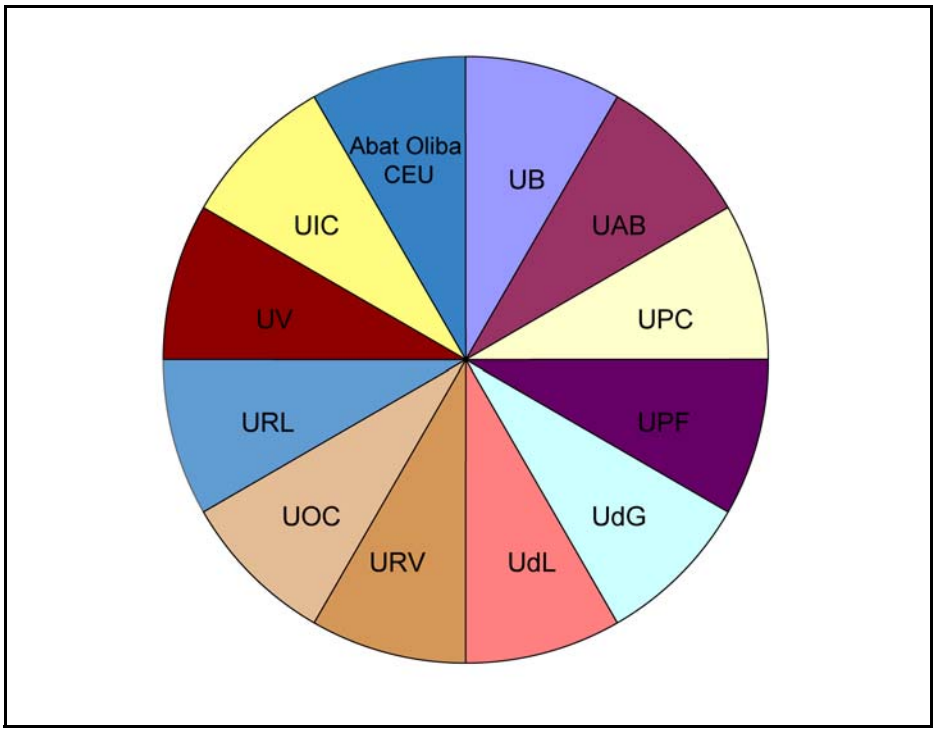
Part 2

Profile of the teaching staff and students of the university system of Catalonia

2.1. Introduction

The origins of the Catalan university system date back to the thirteenth century and it is now composed of twelve universities that are represented on the Consell Interuniversitari de Catalunya (Inter-University Council of Catalonia) and recognised by the Catalan parliament. Of these, the following are considered public: the Autonomous University of Barcelona (UAB), the University of Barcelona (UB), the University of Girona (UdG), the University of Lleida (UdL), the Polytechnic University of Catalonia (UPC), the Pompeu Fabra University (UPF), the Rovira i Virgili University (URV) and the Open University of Catalonia (UOC), which is the only virtual university. The private Catalan university system is formed by the Ramon Llull University (URL), the University of Vic (UV), the International University of Catalonia (UIC) and the Abat Oliba CEU University.

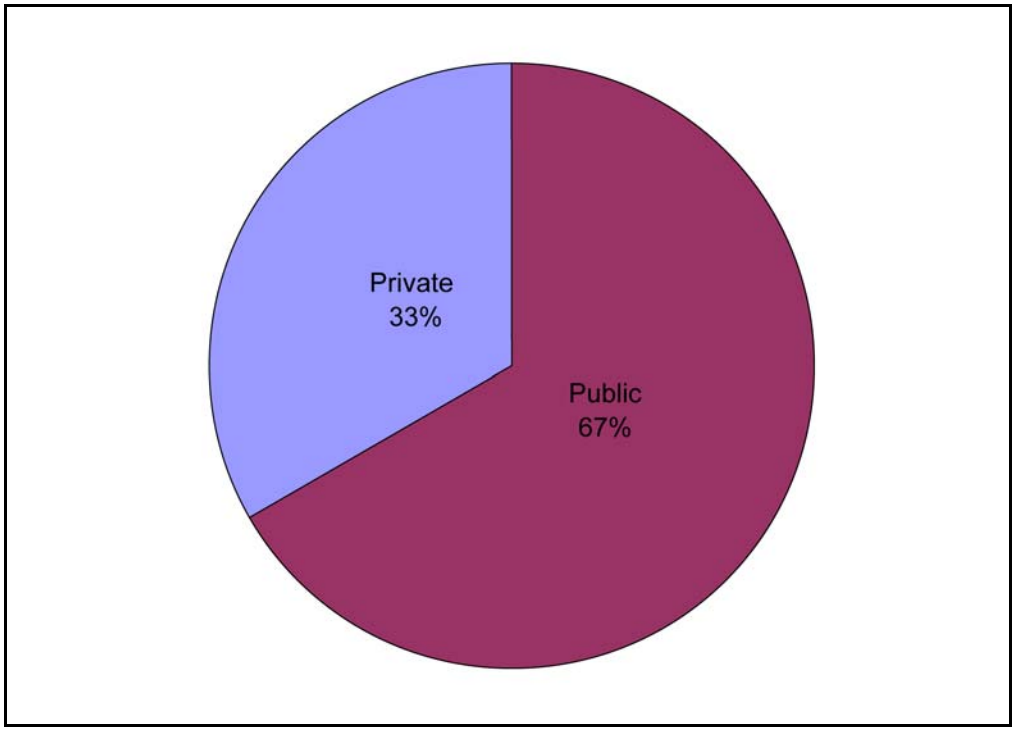
Figure 2.1. Universities forming part of the university system of Catalonia



Source: Department for Innovation, Universities and Enterprise of the Generalitat of Catalonia and own work.

As illustrated in Figure 2.2, approximately 67% of the university system of Catalonia is public. However, this does not mean to say that 67% of students in Catalonia study at public universities. There are, in fact, many more than this but not all universities supply information on their students to the Comissionat per Universitats i Recerca (CUR, Commissioner of Universities and Research), so the exact figure is unknown.

Figure 2.2. Public and private universities in the university system of Catalonia



Source: Department for Innovation, Universities and Enterprise of the Generalitat of Catalonia and own work.

2.2. Students in the Catalan university community

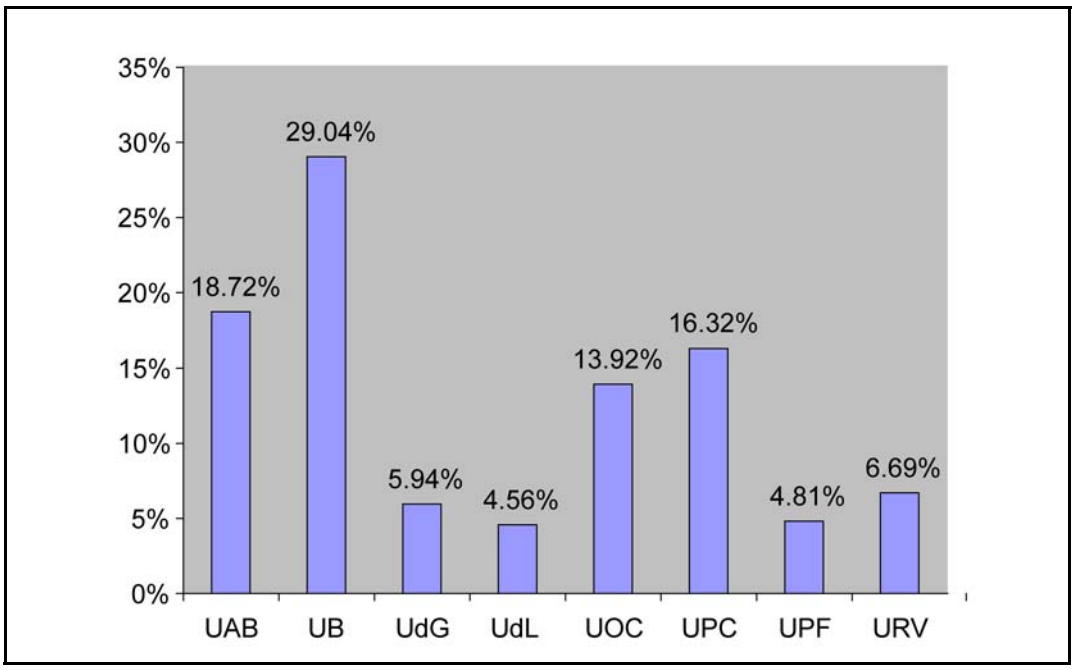
This report takes an in-depth look at the public university system of Catalonia which, as we have said, consists of seven universities with very diverse characteristics. All of the data in this section has been provided by the Department for Innovation, Universities and Enterprise of the Generalitat of Catalonia and refers to enrolments for the 2004-2005 academic year, since the characteristics of students from the 2005-2006 academic year (those analysed in most detail), were unavailable. The data on the UOC were supplied by this university because the Generalitat did not have the information. Figure 2.3. illustrates the distribution of students enrolled in the 2004-2005 academic year in public universities in Catalonia.

First of all, we see that we have one very large university, the UB, which absorbs almost 30% of students who enrol at one of the public universities of Catalonia.

This is followed by two medium-sized universities, the UAB and the UPC, which, together with the UOC (the only distance university in the system), account for 19%, more than 16%, and just over 12% of enrolled students, respectively.

Lastly, we have a series of very small universities, the URV, UdG, UPF and the UdL, which account for the remainder of all enrolled students. None of these reaches 7% of enrolled students.

Figure 2.3. Students in the Catalan university community



Source: CUR, UOC and own work.

a) Characteristics of Catalan students

This section analyses the gender and age of students in Catalonia.

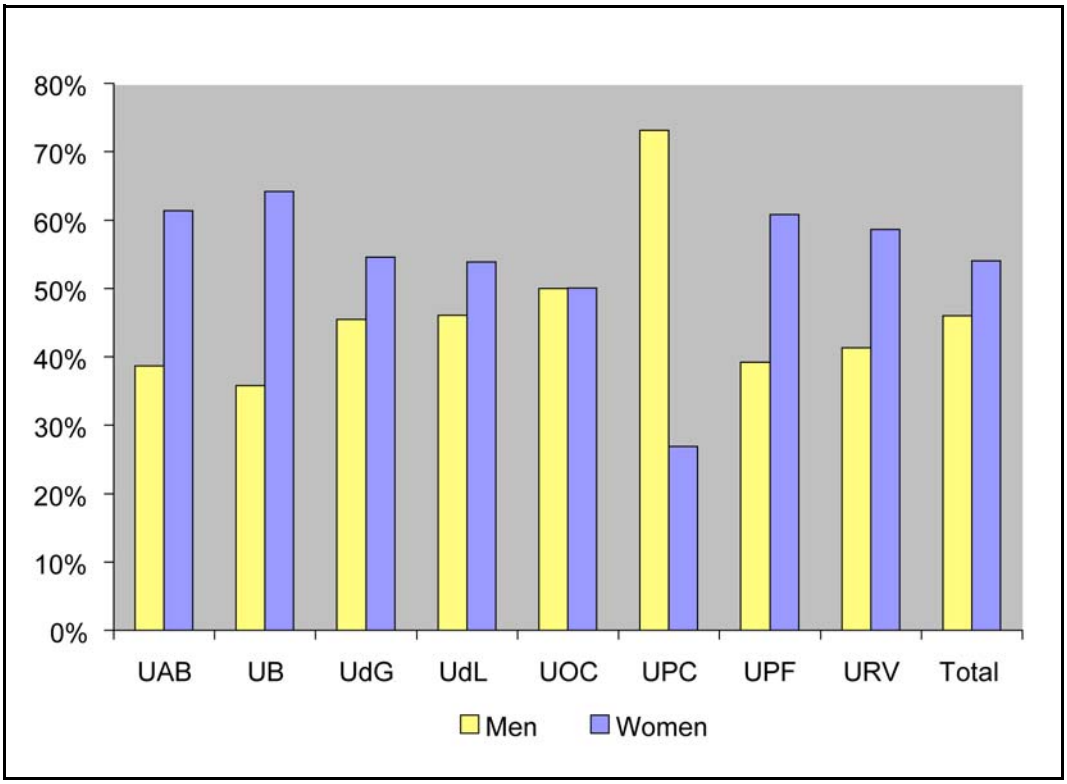
Figures 2.4 and 2.5 illustrate the gender and age distributions, respectively, of students at public universities in Catalonia, both overall and by university.

On analysis of the aggregate data on gender, we see that 54% of students are women and 46% are men. However, when we study this characteristic by universities, the proportion varies from almost 36% to just over 46% men.

Nonetheless, the above situation can be observed in all universities studied except for the UOC and the UPC. In the UOC, we find almost as many men as women and in the UPC, only one in four students is female.

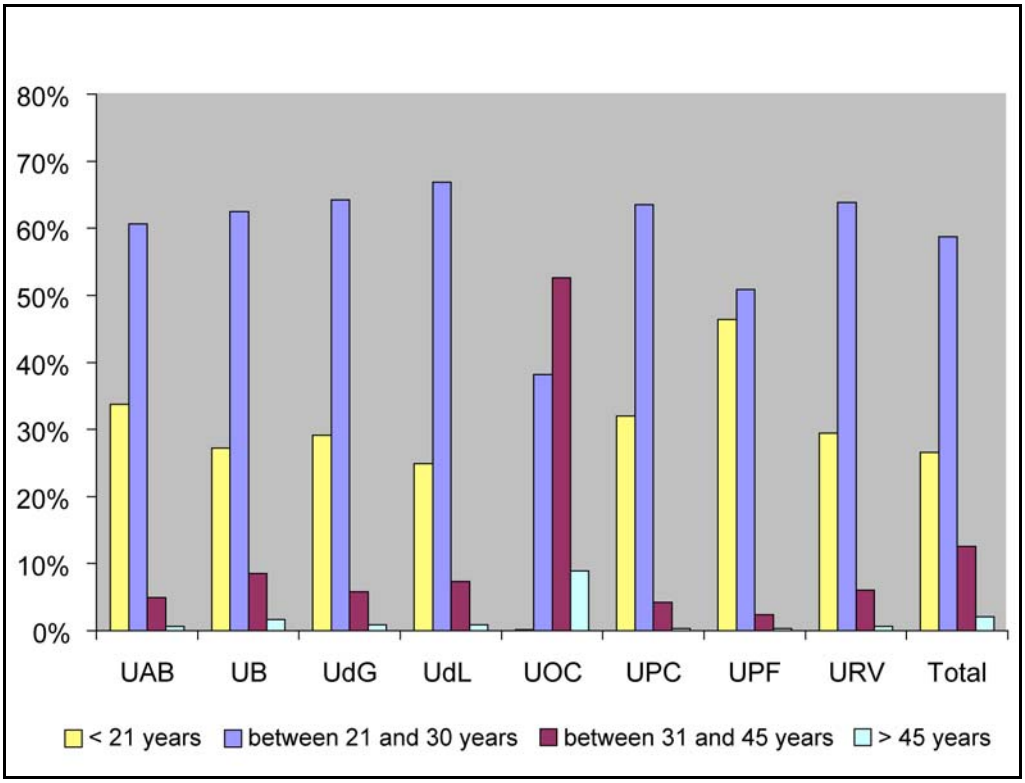
Finally, the universities with more women than men are the UB, the UAB, the UPF and the URV.

Figure 2.4. Characteristics of students in the Catalan university community: gender



Source: CUR, UOC and own work.

Figure 2.5. Characteristics of students in the Catalan university community: age



Source: CUR, UOC and own work.

When we analyse students by age range, the differences are even more remarkable. In general, our students are aged between 21 and 30 years. However, we must make two minor points:

Firstly, students at the UOC are older than those at the other universities studied. In fact, over half are aged between 31 and 45, while students of this age range do not even represent 10% of students at any other university in the system.

Secondly, the UPF has younger students than the other universities studied. The proportion of students under 21 is very close to that of students aged between 21 and 30 years.

When we study these two characteristics simultaneously, however, the conclusions are even more interesting. Tables 2.1 and 2.2 illustrate the distributions of men and women, respectively, by age range.

Table 2.1. Female students of the Catalan university community by age range

University	% < 21 years	% between 21 and 30 years	% between 31 and 45 years	% > 45 years
UAB	37.09%	58.39%	3.91%	0.61%
UB	29.73%	61.21%	7.50%	1.56%
UdG	32.36%	61.80%	4.92%	0.92%
UdL	28.28%	65.44%	5.64%	0.64%
UOC	0.22%	42.23%	49.13%	8.42%
UPC	36.41%	60.63%	2.76%	0.20%
UPF	49.40%	48.02%	2.26%	0.32%
URV	33.88%	60.86%	4.61%	0.66%
TOTAL	**29.49%**	**57.58%**	**10.96%**	**1.91%**

Source: CUR, UOC and own work.

By comparing male and female students on aggregate for the whole system and broken down by universities, we see that there are more women under the age of 21 than men. This is also the case with the UPC, which has far fewer women than other universities.

Hence, we can generally conclude that not only are there more women than men enrolled at the universities, but that they are also younger.

Table 2.2. Male students of the Catalan university community by age range

University	% < 21 years	% between 21 and 30 years	% between 31 and 45 years	% > 45 years
UAB	28.51%	64.20%	6.55%	0.74%
UB	22.82%	64.83%	10.40%	1.95%
UdG	25.23%	67.10%	6.89%	0.78%
UdL	21.04%	68.61%	9.21%	1.14%
UOC	0.16%	34.19%	56.16%	9.49%
UPC	30.37%	64.55%	4.74%	0.33%
UPF	41.85%	55.29%	2.51%	0.34%
URV	23.24%	67.98%	8.10%	0.68%
TOTAL	**23.11%**	**60.11%**	**14.50%**	**2.23%**

Source: CUR, UOC and own work.

b) Subjects studied by Catalan students.

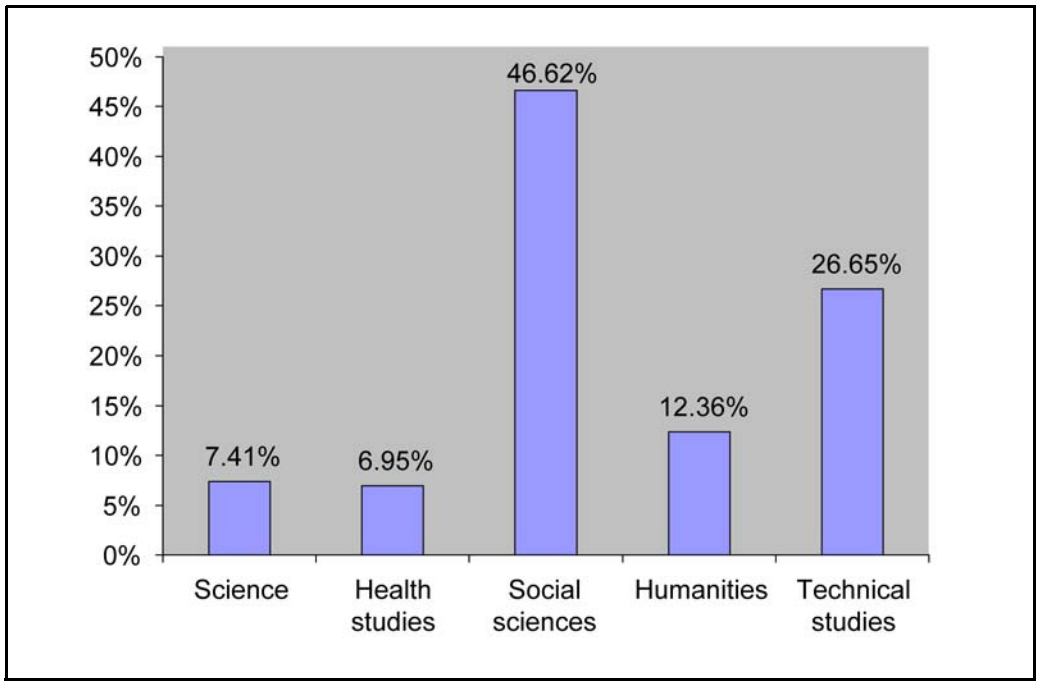
We will now move on to analyse the fields of the subjects studied by students in Catalonia. These fields are defined by the Spanish Ministry of Science and Education, and are: science, health studies, social sciences, humanities and technical studies.

When we analyse the system as a whole, we see that almost half study a social sciences subject. This is quite normal since social sciences include very popular degrees such as Law, Business Studies, and Economics, among others.

Moreover, more than a quarter study some form of technical subject, which includes all types of engineering degrees (Industrial, Computing,...) and Architecture.

Most of the remaining quarter study humanities and, to a lesser extent, science and health studies. Generally speaking, humanities includes all philologies, geographies and histories; science covers physics, chemistry and maths, and health studies encompasses all types of medicine and nursing studies. Figure 2.6 illustrates this distribution for the university system overall.

Figure 2.6. Characteristics of students in the Catalan university community: field



Source: CUR, UOC and own work.

When we group these fields into two – arts and science – the differences between the universities become much clearer. For our purpose, science is taken to cover the fields of science, health studies and technical studies. Arts, therefore, only includes social sciences and

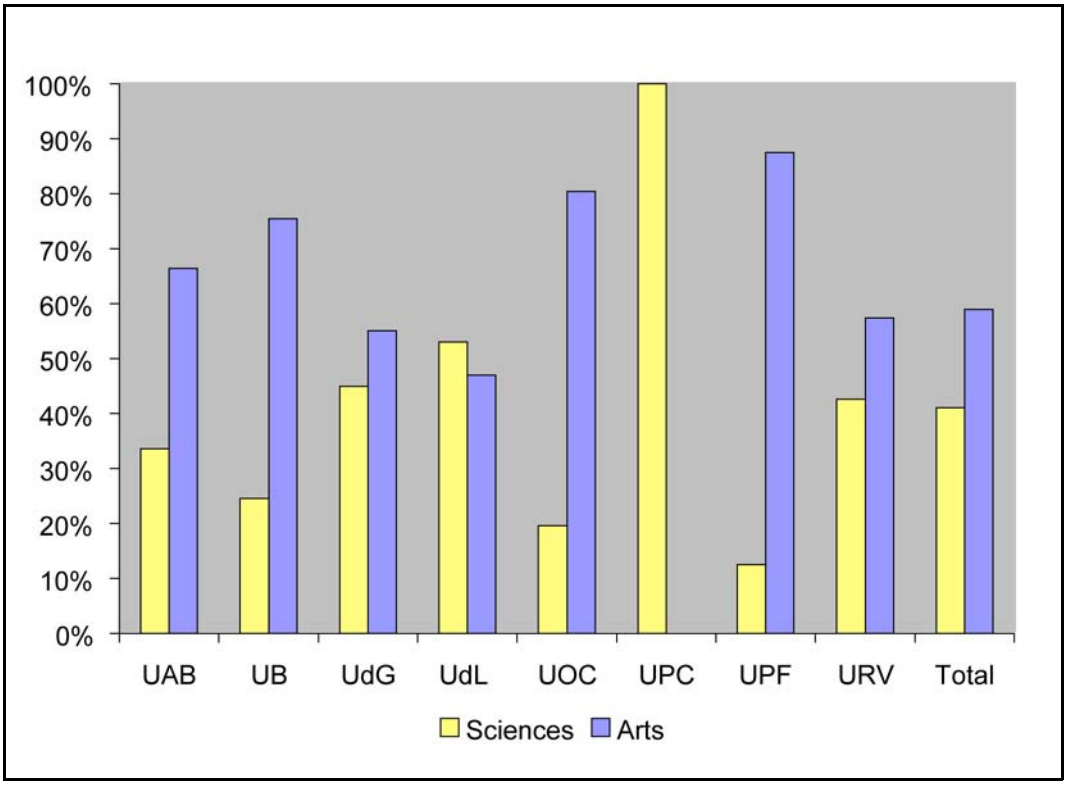
humanities. Generally speaking, we see that there are more arts students than there are science students.

Breaking the data down by universities, we observe that, as the UPC only offers technical subjects, all of its students are enrolled in science degrees.

The UPF, the UOC and the UB, however, offer more arts subjects and more than four out of five students at the first two and more than three out of four at the UB study some form of arts degree.

To conclude this section, we have seen that students in Catalonia are women between the ages of 21 and 30, studying arts degrees, mainly in social sciences.

Figure 2.7. Characteristics of students in the Catalan university community: field group



Source: CUR, UOC and own work.

2.3. Teaching staff in the Catalan university community

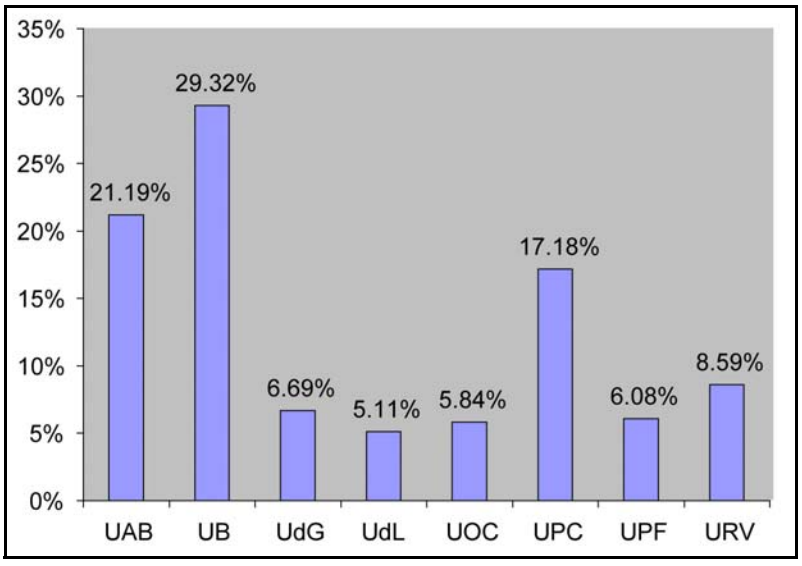
This heading analyses the characteristics of the other agent of the public university system in Catalonia. Here, the data refer to staff who taught during the 2005-2006 academic year at one of the universities we studied.

We saw earlier that the public university with the most students is the UB, so it stands to reason that this university also has the most teaching staff. In figures, almost 29% of all university teaching staff who teach at one of the universities studied do so at this university.

It is also logical that the majority of university teaching staff teach are employed by the UAB and the UPC.

However, it is interesting to note that only 5.53% of these staff teach at the UOC, given that this university accounts for 12% of student enrolments.

Figure 2.8. Teaching staff in the Catalan university community



Source: CUR, UOC and own work.

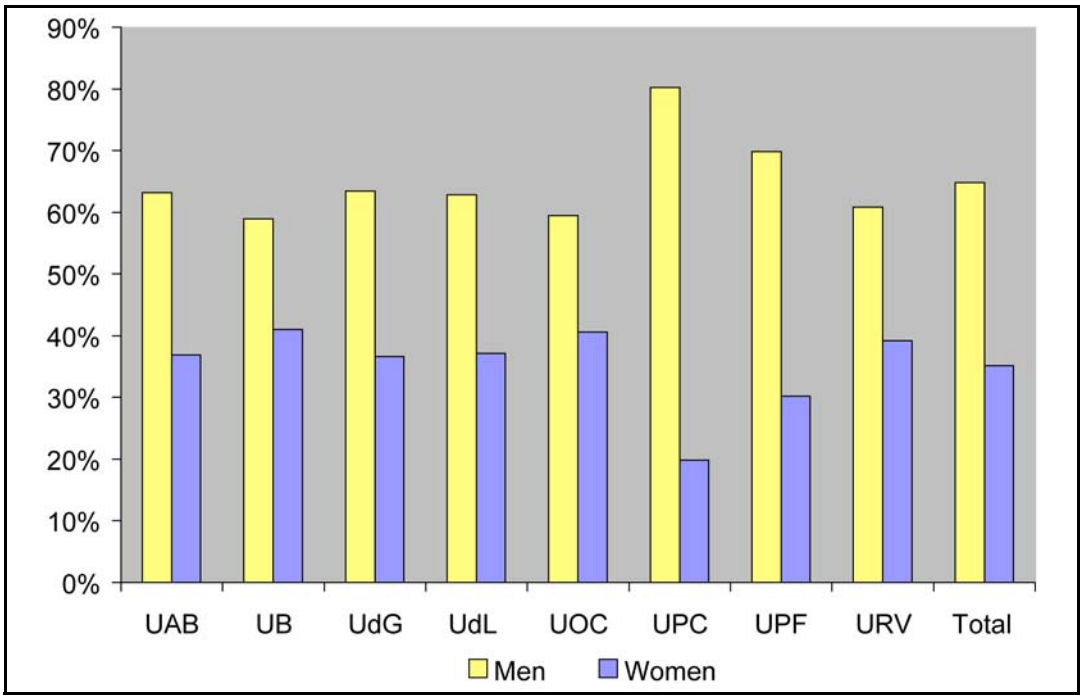
a) Characteristics of Catalan university teaching staff.

Just as we did for students, we will now analyse university teaching staff by gender and age. The distributions of these two socio-demographic characteristics are illustrated in Figures 2.9 and 2.10.

In contrast to students, university lecturers and professors are predominantly male. Overall, two out of every three members of the teaching staff are men. In many of the universities studied, women do not even account for two out of five teaching staff.

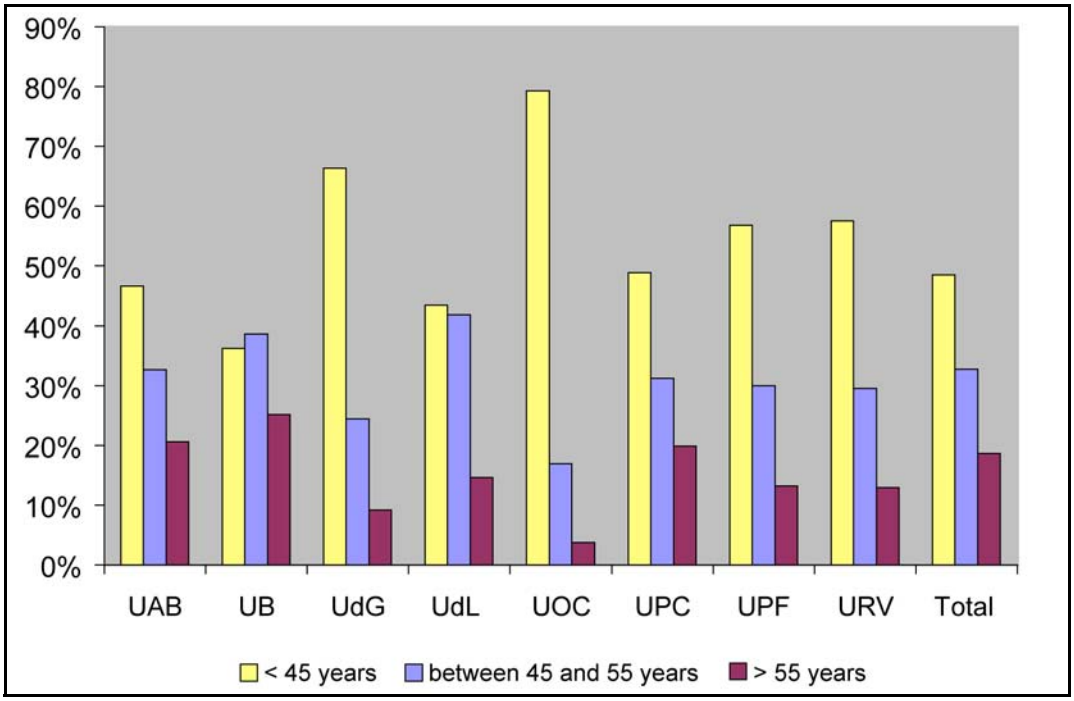
The most extreme case is the UPC, where over 80% of teaching staff are male. Nonetheless, the UPF also stands out from the other universities since women represent just 30% of its teaching staff.

Figure 2.9. Characteristics of teaching staff in the Catalan university community: gender



Source: CUR, UOC and own work.

Figure 2.10. Characteristics of teaching staff in the Catalan university community: age



Source: CUR, UOC and own work.

Figure 2.10 indicates that half of the teaching staff of the Catalan university system are aged under 45 and that just 20% are over the age of 55.

We can also single out one group of universities where the teaching staff are much younger than the rest and another where the teaching staff are considerably older. In the first of these groups, we find the UOC, where 80% of teaching staff are aged under 45, and the UdG, where this figure is almost 70%.

The group of universities with the oldest teaching staff is composed of the UB and the UdL. The UB is the only university in the system with more teaching staff between the ages of 45 and 55 than under the age of 45. Moreover, one in four members of the teaching staff at this university is aged over 55. This proportion is much higher than that found in the rest of the system.

Although the figures for teaching staff aged over 55 at the UdL are similar to those of the other universities, the proportions of its teaching staff between the other two age ranges are very similar. In figures, approximately 85% of its teaching staff are, at most, 55 years old, but around 42% are between the ages of 45 and 55. Hence, the average age of teaching staff at the UdL is considerably higher than the system average.

Table 2.3. Female teaching staff in the Catalan university community by age range

University	% < 45 years	% between 45 and 55 years	% > 55 years
UAB	54.54%	27.93%	17.53%
UB	43.43%	37.37%	19.20%
UdG	73.88%	22.47%	3.65%
UdL	50.00%	40.22%	9.78%
UOC	83.14%	14.20%	2.66%
UPC	61.62%	30.71%	7.68%
UPF	66.67%	22.47%	10.86%
URV	66.12%	25.92%	7.96%
TOTAL	**56.08%**	**30.29%**	**13.49%**

Source: CUR, UOC and own work.

If we analyse gender and age together, we see that the Catalan university community is characterised by having more male teaching staff in the higher age ranges and more female teaching staff in the younger ranges. This is hardly surprising because it is coherent with the general characteristics of the Catalan population and the result of the incorporation of women into the workplace, the effect of which is clearer nowadays.

Overall, the difference between men and women aged over 55 is around ten percent in four of the eight universities studied. The most important difference is observed at the UPC where, although less than 8% of women are aged over 55, almost 23% of male teaching staff at the university are within this same age range.

Our observations on the groups of universities with younger and older teaching staff apply here too. Tables 2.4 and 2.5 show that the UOC is a university with younger teaching staff, both male and female, while teaching staff at the UB are older.

Table 2.4. Male teaching staff in the Catalan university community by age range

University	% < 45 years	% between 45 and 55 years	% > 55 years
UAB	42.12%	35.44%	22.44%
UB	31.22%	39.48%	29.30%
UdG	62.07%	25.61%	12.32%
UdL	39.61%	42.83%	17.56%
UOC	76.67%	18.87%	4.46%
UPC	45.69%	31.37%	22.94%
UPF	52.59%	33.17%	14.24%
URV	51.97%	31.84%	16.19%
TOTAL	**44.38%**	**34.03%**	**21.46%**

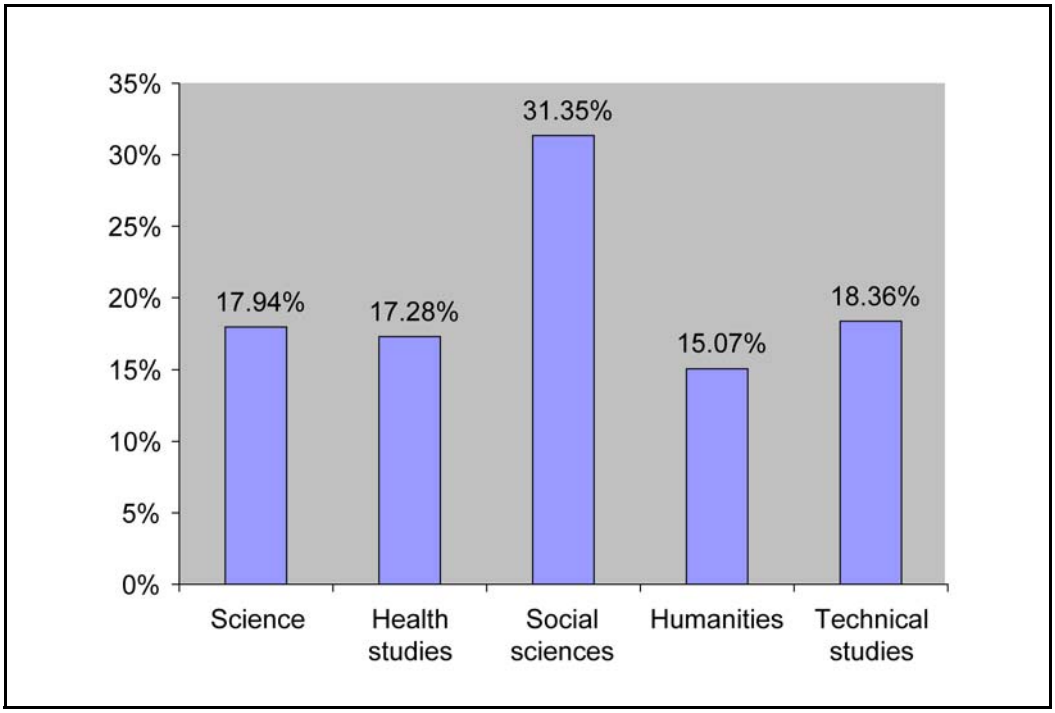
Source: CUR, UOC and own work.

b) Subject fields of university teaching staff in Catalonia

When we studied the field of the courses in which students of the public university community of Catalonia were enrolled, we saw that the vast majority were social sciences. This section will illustrate the distribution of teaching staff, though this time, according to the field of their department or the subjects in which they lecture, whether in the classroom or virtually.

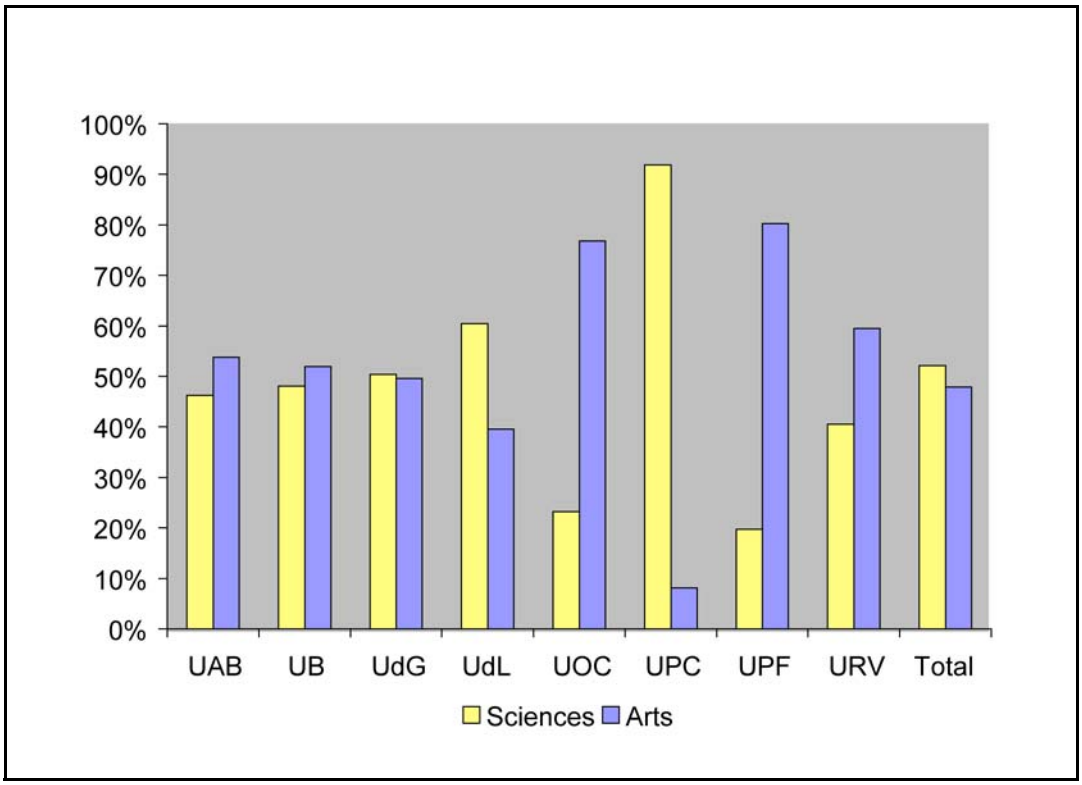
Our analysis shows that while there are more social sciences teaching staff, the spread in other fields is much more even than it was with students. This is because, although students in the university system are enrolled in a subject that forms part of a given field, the teaching for that subject does not necessarily have to coincide 100% with the field. The reason for this is that, in order to give students a quality education, they must learn a series of skills from other fields across the range of studies offered by the university.

Figure 2.11. Characteristics of teaching staff in the Catalan university community: field



Source: CUR, UOC and own work.

Figure 2.12. Characteristics of teaching staff in the Catalan university community: field group



Source: CUR, UOC and own work.

Thus, we observe that over 30% of professors and lecturers teach social sciences followed, in descending order, by technical studies, science, health studies and, lastly, humanities. With the exception of social sciences, however, the differences between the percentages of the different fields are very slight.

Again, we see very marked differences when we study the fields as two groups, science (technical studies, science and health studies) and arts (social sciences and humanities). Generally speaking, there are more teaching staff for science than there are for arts.

The UPC is the university that predominantly teaches science subjects while, at the other end of the scale, we have the UPF, where the majority of teaching staff lecture in arts.

To briefly summarise the profile of university teaching staff in Catalonia, we can say that there are more men than women, particularly at the UPC and UPF, many of whom are aged under 45 and teach more science subjects than arts.

Part 3

Conclusions of the chapters

3.1. Non-academic use of the Internet by the university community

For its socio-demographic and educational characteristics, the university community is one of the most active social sectors in the use of the Internet. Most university students and teaching staff have advanced technological skills levels and the vast majority have their own computers and a broadband Internet connection in their homes. They generally have a fairly high frequency of Internet use, connecting to the Internet almost every day of the week in active sessions of 1 to 3 hours. The majority of students claim to have 4 years' experience in the use of the Internet and this figure rises to over 7 for teaching staff.

The vast majority of university students affirm that they use the Internet regularly for between 10 and 19 activities, generally at a reasonably high intensity. Teaching staff, on the other hand, affirm that they use the Internet for between 7 and 11 activities, also at a fairly high intensity though slightly lower than their students.

Three quarters of university students and teaching staff have been typed on the basis of their responses as active users of the Internet as a means of expression and dissemination of contents. Only 25% of students and 20% of teaching staff consider themselves to be passive users in the sense that they only use the Net as a source of information; they consume information but do not contribute to the Internet's expansion by adding information and content. Of the active users, over 50% of teaching staff and students are creative, i.e. they indicate that they have created websites for the expression and diffusion of contents.

Lastly, the majority of the population affirms that their use of the Internet has changed the amount of time spent on social and everyday activities. Most indicate that they work and study more from home and watch less television as a result of their Internet use; high percentages of the population also affirm that they sleep less and have cut down the time that they spend doing nothing.

Nonetheless, this general data conceals significant internal differences despite the cultural and socio-demographic homogeneity of the population that makes up the university community. Younger students and men studying science subjects reveal more experience in the use of the Internet, increased connection frequency and more advanced technological skills than higher age ranges and women studying arts subjects.

These differences also come to light when we analyse volume and intensity of Internet use. The variability detected in the number of times the Internet is used and the intensity of these produced major differences across the groups that we studied. These differences could be

signalling a second digital gap, now that access to the Internet is guaranteed, this time based on the considerable divergence in uses by some users as compared to others.

We believe that an important factor in explaining the appearance and gradual increase in these divergences in the number of uses of the Internet and their intensity lies in the differences in the skills levels of the members of the university community. We have seen that those who consider themselves to have more advanced skills levels, whether they be students or teaching staff, are also the same individuals who indicate that they conduct more activities on the Internet and use it more intensively; they are also the most active in creating on-line spaces for expression and diffusion and have been most influenced by the effect of the Internet on the time they spend on everyday activities.

We consider expertise to be a useful tool in gauging the possible existence of this hypothetical second digital gap, in analysing the profiles of more active users and in detecting future differences. It could also be useful as an indicator of possible ways of correcting existing differences. If we accept expertise as a relevant element of the analysis of Internet use, we will have to accept that training in the use of the Internet and the diffusion of future services, tools and web spaces are essential if we are to prevent this gap from widening.

3.2. Internet and the teaching/learning process

The overall conclusions of this chapter of our research are ambivalent towards the results obtained. On the one hand, we confirm that the university community (students and teaching staff) not only have considerable skills and expertise, and reveal a considerable expansiveness in their use of the Internet, but that they are also very predisposed to using the Internet in the education process. A total of 73.94% of students consider themselves ready to learn on-line and 41.65% of teaching staff consider themselves ready to teach over the Internet. However, the reality indicates that, in practice, teaching and learning processes do not take advantage of the potential of expert users who are highly motivated to use the Internet for educational purposes. The number of students who have not studied a subject that incorporates the Internet is 53.80%, while 45.98% of teaching staff have not given classes incorporating use of the Web.

We need to ask ourselves the reasons for this ambivalent reality. One reason is the lack of a clear strategy for incorporating and using technologies at the higher education institutions in the system. Although the current trend seems positive, it is mainly due to the need to apply the guidelines of the process of incorporation into the European Space for Higher Education (EEES). These guidelines include the incorporation of information and communication technologies as a complementary part of classroom teaching. Based on previous studies of our system and others in different parts of the world, we can confirm that the introduction of technologies is overdue and motivated by the demands of society and students rather than an institutional strategy to introduce improvements.

Whether or not a subject is taught on-line or the Internet is used for more or less educational purposes is not only the result of a personal decision made by the student or teacher, it is the consequence of an institutional action, which should be strategic. This institutional action should take the form of the selection of administrative systems that use technology to enable the management of academic and extra-academic operations anywhere and at any time. This institutional action also defines the technology platforms that must allow teaching and learning. Moreover, this action must also allow the definition of a teaching and learning strategy, an educational model that incorporates use of the Internet into everyday classroom dynamics. The lack of institutional strategies on academic use of the Internet can be witnessed in the low percentages of academic experience with the latter. Thus, it is not true that students do not want to study courses that incorporate technologies, but rather that the institutions do not offer them as common practice and that teaching staff are not wholly open to their incorporation.

A total of 48.71% of teaching staff recognise that there is a lack of institutional strategy for the introduction and use of the Internet and make a clear request for more institutional support and recognition for teachers who actively introduce ICTs into their teaching.

Students value use of the Internet in higher education and affirm that it has a fairly and very positive impact on their learning in 70.90% of cases. This figure confirms the positive perception of the Internet. Along these same lines, 51.75% of teaching staff consider the Internet to be beneficial to the learning process of students. This opinion is complemented by other data of interest confirming the importance of the multi-channel aspect of any action to introduce technology. Students always prefer to have both action and interaction in teaching. On the one hand, they accept the telematic channel of communication and access to information and, on the other, they accept the traditional channel of access through classroom presence. This requested duality is confirmed by actions such as having classroom material available both on paper and in digital format, taking notes from teachers but also having classroom materials available in file format, accessing the library and its digital catalogue, etc.

One interesting fact is the statement that the hypertextual architecture of the Internet is a positive factor for younger students, i.e. individuals who have been exposed to the dynamics of the information society since they were born and who have been educated with some learning strategies facilitating use of the Internet as a tool for accessing education. For more mature students and teaching staff, the hypertextual logic of the Internet highlights their inadequacies in terms of appropriate learning strategies for its use.

Despite a readiness to use the Internet for educational purposes and the learning strategies adapted to hypertextual logic of younger students, even they have not yet developed the habits that would allow them to make the most of the Internet's potential, either for academic or for non-academic use. The Internet continues to be used mainly for searching for information and communicating by e-mail or instant messaging. Social website tools (wikis, blogs) or those encouraging collaborative dynamics are still not an intrinsic part of the Internet use of the university community.

Use of the Internet for educational purposes and access to the prodigious volume of information of this tool give rise to misgivings, particularly among teaching staff, over the rigour and quality of the information obtained. Students do not question this aspect as much but state that they rarely plagiarise the information they obtain. Teaching staff, however, do not believe this and openly state that the Internet is a source of plagiary by students. There is also a contradiction among teaching staff because, although they do not consider the information obtained from the Internet to be rigorous, they regard it as the best place to publish their research or academic articles. This begs the question as to whether teaching staff recognise their own skill in analysing and selecting information but dismiss this possibility in their students. Although it is true that experience and knowledge of a field is essential if we are to rigorously select information from that available on the Internet, we cannot rule out this skill in our students.

The Internet is used mainly in teaching and learning at university to find information, work on projects (in the case of students) and prepare classes (in the case of teaching staff), as well as for communication, particularly two-way between students and teaching staff. It is rarely used for other purposes, such as cooperation, debate, knowledge sharing, etc. Besides recognising that they rarely share their resources on the Internet (50,06%, rarely or never), teaching staff also state that they rarely use those that they find on it (64.29%, rarely or never).

In spite of use of the Internet for educational purposes that we have explained, both students and teaching staff consider that universities should offer more on-line courses. A total of 61.19% of students said that they were somewhat or very much in favour of this as did 44.97% of teaching staff. The desire for change is complemented by a high demand for courses to learn correctly using ICTs from 63.29% of students and a request from 52.22% of teaching staff for specific training on how to incorporate ICTs into university teaching. This confirms our statement that both students and teaching staff believe that they have an expert use of the Internet in non-academic spheres but recognise their failure to make the most of this potential in their professional activity, be it as learners or teachers.

This chapter has analysed the two most relevant methods of using ICTs in higher education: the hybrid method and the on-line method. The hybrid method is one that complements classroom learning with distance learning by harnessing the potential of the Internet, while the on-line method does away with classroom teaching entirely. In the higher education system we have analysed, all of the universities offer hybrid courses and there is one that offers all its courses exclusively on-line or virtually.

In conclusion, we can state that there are no major differences between the assessments and uses of the Internet by students and teaching staff with these methods. Although the on-line method obtains somewhat higher percentages in the principles of autonomy, time flexibility, organisation, personalisation, etc, we cannot say that the differences are very substantial. This leads us to reflect on the reasons for these similarities. In our study, the causes lie in a straightforward, institutional strategy of introducing and using the Internet in teaching that is based on the incorporation of basic technology platforms rather than on an analysis of the methodologies and tools that would promote or encourage learning. Moreover, because of the code imposed by the technology platform, there is a lack of innovative models of education, even in the system's distance university, that would foster the more social, relational and cooperative elements of Internet use for educational purposes.

One of the figures confirming our hypotheses is that obtained by comparing the variables on interaction in the two educational methods. The greatest interaction occurs between stu-

dents and teaching staff, while the lowest takes place between students. This level is similar for students of both the on-line and hybrid methods, which shows that the traditional teaching model based on communication between student and teacher is maintained in the educational methods that use the Internet, whether complementary or entirely. In an information model in which either of the two groups involved in the teaching/learning process can access information, we see that the traditional model of two-way interaction between student and teacher, informant and recipient, is reproduced. Thus, we can confirm that the educational model has not changed. Since there are no clear guidelines or policies to foster use of the Internet, innovative institutional actions rarely become educational methodologies. Actions by groups of students and teaching staff take place in isolation, without the potential for introducing global change, at least initially.

Hence, we can conclude that the educational institution of the higher education system studied is in an early phase of using ICTs – particularly the Internet – for educational purposes. Although the preliminary phase of introducing basic technology infrastructures to universities in order to access and use the Internet has been completed, albeit without strategic planning, these institutions are still in an introductory phase when it comes to the Internet's potential for change in education. To continue making progress in the use of the Internet for educational purposes, we need to make headway with policies that will stimulate and recognise teaching staff who are active in these areas and that will encourage the generation of institutional models of education that are both active and transformational in their use of the Internet, taking maximum advantage of its social potential.

3.3. The Internet and academic performance based on university results

This chapter studies the influence of technology on academic performance in a general model of determinants of the latter. Thus, we have divided it into the variables of social environment, institutional environment and personal environment.

Generally speaking, we can affirm that social environment variables do not play a very important role in the academic performance of university students, with the exception of those that connect students to the workplace. In this case, students juggle their studies with some form of employment and those who have a more entrepreneurial spirit have poorer academic performances than the rest. The institutional environment variables measured by our study were the least important group when it came to determining academic performance. Personal variables, however, were seen to have a much greater impact on the academic results of university students, particularly age and all aspects relating to the student's academic transcript, together with the credits they were awarded out of the total theoretical credits of the course in which they enrolled.

The more specific part of this study, analysis of the Internet 's impact on universities, indicates that new technologies are not the main reason for obtaining a given academic result. In fact, a combined analysis of the determining factors of high academic performance reveals that the variables related to technologies are by no means the main ones in explaining the academic performance of Catalan students.

Nonetheless, our analysis shows that use of the Internet is gradually becoming an influential variable on the academic performance of university students in Catalonia. Our results indicate that this influence is negative when we come to discuss non-academic use. Here, we can confirm the relationship found by similar studies, which indicate that students who use the Internet more have less time to spend on their academic work and, logically, have a poorer academic performance. Thus, it has been empirically proven that there is a series of factors that have a negative impact on student results. In the context of advanced skills and expert use of the Internet and computers, Catalan university students record poorer academic performances when they make more intensive use of free software, have a more participative and creative approach to the Internet, use the Internet for many reasons and when they change their habits too much.

The relationship with academic use is not so clear. At first sight, it would appear that the greater the academic use the better the results of the academic transcript, which is true of individuals with lower levels of education (Sigalés et al., 2007). However, our analysis found that this is not always the case.

Firstly, we see a positive relationship when ICTs are used as a complementary tool for being more active, communicative and participative in the subjects studied. Thus, variables such as use of the Internet by students to communicate with teaching staff and classmates allow them to obtain better results. In addition, the use of on-line services offered by libraries, experience in studying a subject with the Internet (whether on-line or semi-distance), and studying more from home with regular Internet use are all variables that have a positive impact on academic performance. However, we need to remember that these conditioners are strengthened by a prior requirement that will allow students to make the most of the opportunities for involvement and participation offered by ICTs: they must not come up against major obstacles to use of the Internet for academic purposes.

We can also confirm that a learning style favouring Internet use has negative effects on academic performance. Being more predisposed to the information architecture and attaching greater reliability and rigour to the sources of information found on the Internet also have a negative role in the results of university students. One possible explanation for this has been mentioned in previous chapters: universities are failing to uphold a teaching methodology that is predisposed to Internet use. Currently, when work is assessed, the more traditional areas of the teaching process are given greater importance than those based on new technologies. In this context, we should bear in mind that the gradual introduction of the European Space for Higher Education could change this dynamic and adapt the style of teaching to a learning style in which the use of ICTs is a positive factor. However, at the time that our study was conducted, this was not the case and will probably be the cause of poor performances from students with a learning style that is more predisposed to Internet use.

The other technological variables with a negative influence on academic performance include two that refer to a change in habits: attending class and visiting libraries less since beginning to use the Internet has a negative influence on academic performance. There are two possible reasons for this. Firstly, the change favours non-academic activities and secondly, the added value of attending class and visiting libraries is substituted by information found on the Internet. Thus, we see that the use of ICTs to complement classes in the learning process encourages academic performance but has the opposite effect when we attempt to replace university teaching with independent study based exclusively on information found on the Internet.

Economic background has an influence on at least three relevant aspects of Internet use. On the one hand, we have a non-academic aspect – expert use – and, on the other, two closely related academic factors, use of the Internet to study courses and the change in study habits whereby the Internet is used to study more from home. Thus, the better the economic background of students, the greater their expertise in Internet use and the greater

their use of the Internet to attend courses of study. An indirect consequence of this would be that they use the Internet more to study from home.

To finish off, although greater expertise does not promote excellent academic performance, a change in habits encouraging more home study following the introduction of the Internet is associated with better results. Hence, we cannot conclude that Internet use associated with a given economic background results in better academic performance, as is the case with primary and secondary education (Sigalés et al., 2007).

3.4. Use of the Internet in university research

Use of the Internet in academic research is a deep-seated reality in the university system of Catalonia and has led to improvements in access to information, communicative group research and dissemination of this research.

If we look closely, we see that the bulk of teaching staff use the Internet to find information (only 24.66% of teaching staff at Catalan universities do not receive any information from distribution lists, though this figure does not include information found independently, which would have reduced it substantially).

We also see that use of the Internet for communicative group research is fairly common, particularly when participating in on-line research networks and in the case of passive subscription to distribution lists for research purposes. Nonetheless, active participation in spontaneous virtual communities without institutional backing is very low. Despite these positive results, we need to make two points here:

- Firstly, participation in on-line research networks occurs mainly in networks set up by the university, which suggests that the physical barriers with new technologies have not been overcome as much as they could be.
- The second point is more methodological and concerns the fact that our quantitative study does not measure the intensity of participation in research networks. As a result, we cannot categorically state that this use of the Internet for collaboration purposes is intensive.

The Internet has become a key format for publishing research for three main reasons: the prestige of certain on-line journals, publishing ease and the collectivisation and free dissemination of knowledge. This on-line publishing generates new information on the Internet which, as we have seen, is sought out for research purposes, hence refuelling the dynamic. In the light of this, we can say that the Internet is used more as a giant warehouse where information can be found and published than as a tool for collaboration.

Lastly, analysis of Internet use by different research groups shows that there is a series of characteristics defining the profile of users in the diverse fields of research analysed in this chapter. Thus, the characteristics defining the profile of users of the Internet for general research and to publish their research – profiles that overlap – are:

- Being a member of a university with non-technical classroom teaching.
- Young male or female.

- Exclusive dedication to academic activity (not combined with any other remunerated activity).
- Forming part of a science department.
- Low job category (scholarship holders or assistant teachers).
- Minimal teaching experience (over 5 years), affording them a certain category in the research system.
- Advanced computer skills.
- Participative or creative approach to information on the Internet for personal use.
- User of the Internet for teaching, specifically for preparing and teaching classes.
- Experience in teaching semi-distance education.

The characteristics of the profile for more communicative and collaborative research are:

- Being a member of a virtual or technical university of the system.
- Exclusive dedication to academic activity, without combining it with any other remunerated activity).
- Forming part of an arts or science department.
- Scholarship holder (or professor in the case of membership of on-line collaborative research networks).
- Between 5 and 14 years' teaching experience.
- Advanced computer skills.
- Participative or creative approach to information on the Internet for personal use.
- User of the Internet for teaching, specifically for preparing and teaching classes.
- Experience only in teaching on-line education.

3.5. Catalan university libraries in the information era

Because of the changes they have had to make to survive as an institution by adapting to the information society, university libraries have come a long way from simply being a place where books are stored and organised for later reference. With the introduction of new technologies – in which university libraries were pioneers – and the European Space for Higher Education (ESHE) and the European Research Area (ERA), librarians have multiplied their duties and become a key part of the university community – even more so if we consider the importance of information knowledge in modern society. The transformation of digital libraries into Learning and Research Resource Centres (LRRCs) will depend on political will and the investments made in this regard. Given that this reorganisation would require centralising currently disperse areas into a single body, we can expect the typical resistance associated with organisational change. Thus, management of changes and the allocated budget could be key to the speed with which this change, necessary for the new model of European universities, is implemented.

Another important change is the format in which information can be accessed through libraries. Paper is currently making way for digital media in libraries, including virtual formats for which libraries very often limit themselves to being gateways. This situation is mainly seen in the databases of fee-based electronic journals.

It is precisely this payment for electronic information that has led to two transformations in libraries. The first of these is a change in mentality, since the belief that the fees charged by electronic journals are abusive has introduced and spread an open-content philosophy in university libraries in Catalonia. The second transformation is a collaborative, organisational change. As is the case in other countries, Catalan libraries have had to associate in order to purchase electronic information and access greater volumes of the latter, thus initiating a very advantageous mode of collaboration that has exceeded its initial aim and spread to other areas. The dynamics of this could be extrapolated to other areas of university life.

Teaching staff use the on-line services studied (consulting catalogues, consulting databases and available on-line journals, reserving, requesting and renewing borrowing periods, and requesting information and documentation by e-mail from libraries for academic activities) more than students do. Notably, requesting personalised information for academic activities, which is the service of the questionnaire most closely related to the operating dynamics of LRRCs, was the least used service, which shows that the study dynamics of the ESHE have still not been incorporated and libraries are not yet seen by the university community to support learning, teaching and research. In contrast, the traditional notion of a digital library where content can be accessed in whatever format still prevails.

Our analyses have also highlighted some regular features both for students and teaching staff, which we will now discuss by way of a conclusion to this chapter:

- In the field of socio-demographic characteristics, there is a gender difference in the use of the on-line services offered by libraries, since women tend to use them more than men.
- Both students and teaching staff at universities offering non-technical classroom teaching use the Internet more to consult the catalogue and databases of on-line journals. In this case, students and teaching staff of arts subjects revealed higher percentages of Internet use for accessing library services.
- Individuals with more advanced computing skills and Internet expertise use these on-line services more, although a very high level of expertise is not required, which suggests that they are user-friendly and accessible.
- Although these services are on-line, there is a clear relationship between connecting from the library and using these services, which indicates that a considerable number of students and teaching staff use them at the library, probably influenced by the environment and the fact that it is the traditional place for finding information.

We also need to include the following relationships regarding use of on-line library services by students:

- Students at universities offering non-technical classroom teaching make greater use of all of the on-line services offered by libraries that we analysed.
- Students with timetables that include subjects both in the morning and afternoon use more than those whose timetable only includes subjects taught either in the morning or in the afternoon. Students in their first year use the services we studied less because of ingrained habits adopted from the teaching/learning model used in their secondary education.
- Students state that they have a learning style predisposed to use of the Internet and those who affirm that use of the Internet helps with independent learning use the services we analysed more.
- Students who consider that the information found on the Internet is of good quality use the on-line services of libraries less because they substitute the information that they can find in libraries for that found on the Internet without feeling that they are compromising on quality.

The special features of teaching staff in this respect are different, but the relationships they share with students are:

- Teaching staff of the system's virtual university use the on-line services of libraries more, with the exception of consulting their catalogues.

- Teaching staff who are scholarship holders with teaching duties or assistant teachers make greater use of all services analysed because their lower prestige means that they carry out more routine tasks, such as bibliographical research, and because of the generational effect. Teaching staff with exclusive dedication to academic work use the services more than those who combine teaching with another remunerated activity, no doubt because they cannot afford to spend as much time on them.
- Teaching staff who use the Internet to prepare and teach classes (two closely related uses) also use the Internet more to access on-line library services. This is logical, particularly given that one of the possible uses of the Internet in the preparation of classes is finding information on the Internet using on-line library services.

3.6. Entrepreneurial spirit of the university community

There is a negative correlation between Internet use and the entrepreneurial spirit of university teaching staff. One possible explanation for this is age difference. Older generations are naturally less likely to be advanced users of the Internet and tend to take part more in entrepreneurial activities related to their professional career outside the university.

Another possible reason is that the entrepreneurial activity of teaching staff includes parallel activities, such as managing staff, attending meetings, writing up proposals, etc., and hence, they do not have enough time to use the Internet.

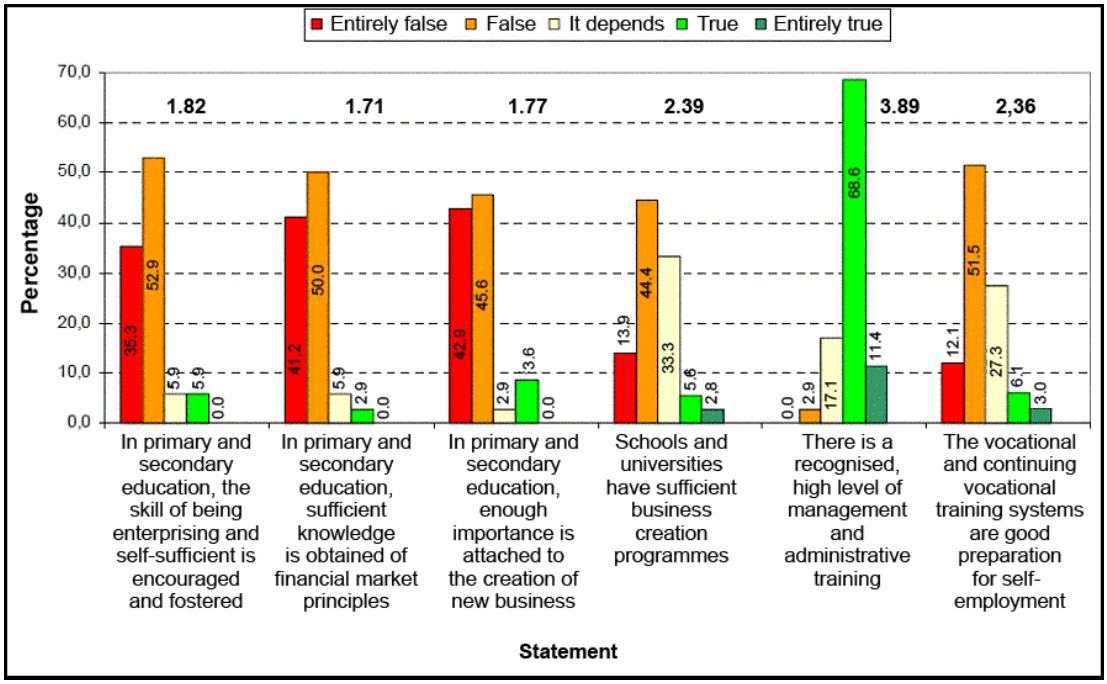
In all events, although these two explanations could go hand in hand, the first is probably more common than the second.

It is almost exclusively older researchers in natural sciences who take part in the eight entrepreneurial activities studied. These academics generally have a scientific career spanning more than twenty-five years, which means that they completed much of their education and initial training before the Internet developed its omnipresent influence. It will be interesting in the future, when those who do not form part of the Internet generation have retired, to see whether the correlation between entrepreneurial activity and Internet use by teaching staff shifts to the positive correlation we find among students.

The results of our study do not generally echo the positive impression of the GEM 2003 report. It is interesting that our results do not coincide with the assessment of local experts on the role of the Catalan education system in its preparation of students for professional life. The experts gave low scores to the Catalan system in almost all areas (see Figure 3.1), although the highest score was awarded to the Catalan university system. The vast majority considered primary and secondary education to be deficient in vocational training, knowledge of the economic system and fostering of entrepreneurial spirit. Although the majority (58.3%) also believed that there were not enough programmes for business creation, a third of the experts stated that special cases had to be taken into account and 8.4% believed that the task of the universities was sufficient.

A more positive assessment was made of management training, taught basically at universities. In this study, 60% of experts believed that more effort had to be made with continuing vocational training, since virtual universities will practically take over all training at this level.

Figure 3.1. Expert opinion on education (GEM 2003)



Source: GEM 2003

To sum up, research on entrepreneurial spirit and, ultimately, business creation would appear to indicate that a high percentage of the population of Catalonia has the necessary motivation but this is not corresponded with support from their environment. Specialist institutions such as UPCinnova have obtained good results and can be used as a model for tasks carried out at other universities.

Perhaps one of the most interesting areas is the vast heterogeneity of data on entrepreneurial activity at the different universities and in Catalonia in general. The discrepancies appear to be due to different measuring methods but also to the possibility of a positive bias towards research. In other words, when the survey concerns Internet use, the results are more positive; the same can be said of entrepreneurial activities. The two effects complement each other: firstly, respondents with a greater knowledge and interest in the specific topic of the survey are those that tend to answer, and secondly, respondents tend to offer the most positive view possible, even though the survey is anonymous.

General conclusions

The following conclusions are the result of processing the quantitative data of the survey applied to students and teaching staff of the university system of Catalonia. The research that we have described includes additional – mainly qualitative – information from the 52 semi-guided in-depth interviews conducted. These interviews, attached as digital appendices to this report, focus on the analysis of different institutional areas related to Internet use in universities (vice chancellors of academic affairs, technology, innovation in education, research and the management of universities, libraries and IT services, among others). The result of these interviews has been partially taken into account to confirm some of the results obtained from quantitative data.

The study population is students and teaching staff of the eight public universities of Catalonia (UB, UAB, UPC, UPF, URV, UdG, UdL) and the UOC. According to data from the CUR and the UOC's Department of Information and Quality, the target study population consists of 170,995 students enrolled in the 2004-2005 academic year at universities offering classroom teaching and at the UOC during the first semester of the 2005-2006 academic year; together with 14,548 teaching staff employed at these universities during the 2005-2006 academic year.

The purpose of the study is to detect and assess use of the Internet by the whole university community, observing the changes that it has introduced in the teaching/learning process of the university. This aim, together with the main hypotheses and research questions, is developed in Chapter One of this research report.

The data was collected using an on-line questionnaire sent to the e-mail address given by the institution and facilitated to the research team by the universities following the decision of the Catalan Data Protection Agency. The questionnaire was applied to a total of 15,348 teaching staff and 193,096 students of the 2006-2007 academic year, figures slightly above those of the population data due to a lack of up-to-date information when this report was written.

The survey response rates were 14.89% for students and 19.28% for teaching staff. After establishing quotas in accordance with the proportions of the population, we were left with a sample of 19,552 students and 2,149 teaching staff, giving us an accuracy level of 0.66% and 1.95%, respectively, for our conclusions. Quota excesses were eliminated at random so as not to compromise the representativeness of the sample obtained.

As a result, given these sampling errors and the fact that we have worked with 11.43% of all students and 14.77% of teaching staff at public universities in Catalonia, our conclusions can be extrapolated to the rest of the university community. We should point out that this

survey was self-appointed and basically contains the opinions of Internet users who make intensive use of the institutional e-mail provided by the public universities of Catalonia.

We will now indicate the main conclusions of the research.

The university group studied (students and teaching staff) has advanced skills in computing and Internet use compared to the rest of the population of Catalonia. Most students – over 82% - state that they have over 5 years' experience in using the Internet, while 81.76% of teaching staff claim to have over 7.

Almost all students and teaching staff have their own computer with broadband connection and connect to the Internet every day. Students log on daily and their connections last 1 to 3 hours, while teaching staff log on every day with average connection times of over 3 hours. The reason for the difference in the connection times of the two groups is that teaching staff calculate their Internet connection time in accordance with their working hours, something that students cannot do.

The university community is made up of very active Internet users, both in the types and intensity of use that they carry out. Most students state that they regularly use the Internet for 10 to 19 activities, while teaching staff use it for 7 to 11.

There is a clear gender difference in favour of men, mainly among students, in the number of times that they use the Internet. We also see that women in the university community begin to use the Internet and computers in general at a later age. However, the younger female generations appear to be bridging this gap.

The study also reveals age differences in terms of the volume of Internet use. We can observe a positive correlation among both students and teaching staff between younger age groups and a more extensive and intensive Internet use. Between 36% and 43% of the population of younger groups affirm that they carry out 16 to 23 activities using the Internet, which we consider to be a high volume of Internet use, while only 26% of older age groups state that they have such a high level of activity.

There is a positive correlation between advanced user skills and a more intensive and extensive – carrying out more activities – use of the Internet. Conversely, less skilled users have a more restricted, limited and less intense use of the Internet.

We can confirm that the introduction of the Internet is affecting the time spent by users on social and everyday activities. The majority of the population declare that they work and

study more from home since they connect to the Internet. Moreover, they make up for the time they previously spent reading the press in paper format by reading it on-line. Lastly; they affirm that they watch less television, sleep less hours and spend less time doing nothing since they use the Internet, confirming that it is a substitute for television rather than for activity.

These changes are clearer among those with more advanced skills levels, since they spend more time connected to the Internet, using it more and at a greater intensity. The more skilled users are systematically the same ones who confess to greater changes in their daily activities, in comparison to less skilled users who largely claim not to have experienced changes as a result of their use of the Internet.

The main conclusion that can be drawn from the data on use of the Internet by the university community for purposes other than education is that we could be witnessing a second digital gap affecting the extension and intensity of Internet use, as opposed to access, which was the reason for the first digital gap. The results show that more skilled students and teaching staff with a more expansive Internet use have more facilities and knowledge for using it to maximum advantage, particularly for educational purposes. This leads us to suggest that we must reinforce our systems of training or accompaniment in creative and active use of the Internet in order to improve performance and optimise the potential of Internet use.

The universities of the system have completed the initial phase of the basic introduction of technology for administrative purposes (enrolment, access to information, libraries, etc.) and have good infrastructures, but they now need to define an institutional strategy that goes far beyond the selection of a technological teaching platform.

From the data on use of the Internet for educational purposes, we can conclude that students and teaching staff are very willing to use the Internet in the education process. A total of 73.94% of students consider themselves ready to learn on-line and 61.65% of teaching staff consider themselves ready to teach over the Internet. However, we also see that 53.80% of students have not studied subjects that incorporate the Internet and 45.98% of teaching staff have not given classes using the tool. This data indicates a failure to introduce an institutional strategy for the incorporation and use of technologies by universities.

The lack of an institutional strategy for Internet use is reflected in the low percentages of experience of academic activity using the latter in the university community. Studying a subject with use of the Internet is not only the result of a personal decision by the student or teacher; it is also the consequence of an institutional action that provides the means required to do so.

A total of 48.71% of teaching staff recognise that there is a lack of institutional strategy for the introduction and use of the Internet and make a clear request for more institutional support and recognition for teachers who actively introduce ICTs into their teaching.

Students value the use of the Internet in higher education and affirm that it has a fairly or very positive impact on their learning in 70.90% of cases, while 51.75% of teaching staff consider this statement to be true. This opinion is complemented by other data confirming the importance of the multi-channel aspect of any action to introduce technology.

Use of the Internet in university studies does not necessarily mean abandoning the traditional classroom method of higher-education processes. Students always prefer to have both action and interaction in teaching. telematic channel of communication and access to information but, on the other, they want the traditional channel of access through classroom presence.

We are witnessing a traditional and non-transformational use of ICTs in higher education, revealed by the dynamics that reproduce the traditional education system based around the teacher but implemented through the Internet. Interaction via e-mail is mainly with teaching staff and the main use of the Internet is to look up information for projects. We do not observe possible changes in the model of education based on the social and collaborative potential of the Internet.

The Internet is mainly used in the education process for finding information and communicating via e-mail or instant messaging. Social website tools (wikis, blogs) or those encouraging collaborative dynamics are still not an intrinsic part of Internet use for the university community.

One interesting fact is the statement that the hypertextual architecture of the Internet is a positive factor for younger students, i.e. individuals who have been exposed to the dynamics of the information society since they were born and who have been educated with some learning strategies facilitating use of the Internet as a tool for accessing education. For more mature students and teaching staff, the hypertextual logic of the Internet highlights their inadequacies in terms of appropriate learning strategies for its use.

The hybrid education method, that where classroom teaching is complemented by intensive use of the Internet for educational purposes, has an excellent potential for introducing change which, though not covered by the study results, could be optimised by the boost given by implementation of the ESHE in Catalonia.

Teaching staff explicitly acknowledge the lack of institutional support and incentives for using the Internet for educational purposes. There is also a clear request for specific training on how to use the Internet for educational purposes. Besides recognising that they rarely share their resources on the Internet (50,06%, rarely or never), teaching staff also state that they rarely use those that they find on it (64.29%, rarely or never).

A total of 61.19% of students are somewhat or very favourable to increasing the range of on-line courses offered by universities, while only 44.97% of teaching staff share their view. This demand is complemented by a high number of requests for studying courses with ICTs by 63.29% of students. The numbers of teaching staff requesting specific training to incorporate ICTs into teaching total 52.22%.

Chapter Five covers use of the Internet for educational purposes and analyses the two most relevant methods of using ICTs in higher education: the hybrid method and the on-line method. The hybrid method is one that complements classroom learning with distance learning by harnessing the potential of the Internet, while the on-line method does away with classroom teaching entirely. In the higher education system we have analysed, all of the universities offer hybrid courses and there is one that offers all its courses exclusively on-line or virtually.

In conclusion, we can state that there are no major differences between the assessments and uses of the Internet by students and teaching staff with these methods. Although the on-line method obtains somewhat higher percentages in the principles of autonomy, time flexibility, organisation, personalisation, etc, we cannot say that the differences are very substantial. This leads us to reflect on the reasons for these similarities. In our study, the causes lie in a straightforward, institutional strategy of introducing and using the Internet in teaching that is based on the incorporation of basic technology platforms rather than on an analysis of the methodologies and tools that would promote or encourage learning. Moreover, because of the code imposed by the technology platform, there is a lack of innovative models of education, even in the system's distance university, that would foster the more social, relational and cooperative elements of Internet use for educational purposes.

One of the figures confirming our hypotheses is that obtained by comparing the variables on interaction in the two educational methods. The greatest interaction occurs between students and teaching staff, while the lowest takes place between students. This level is similar for students of both the on-line and hybrid methods, which shows that the traditional teaching model based on communication between student and teacher is maintained in the educational methods that use the Internet, whether complementary or entirely. In an information model in which either of the two groups involved in the teaching/learning process can access

information, we see that the traditional model of two-way interaction between student and teacher, informant and recipient, is reproduced. Thus, we can confirm that the educational model has not changed. Since there are no clear guidelines or policies to foster use of the Internet, innovative institutional actions rarely become educational methodologies. Actions by groups of students and teaching staff take place in isolation, without the potential for introducing global change, at least initially.

Based on the conclusions drawn from the results of the data on use of the Internet for educational purposes, we consider it necessary to encourage the strategic planning of processes for the introduction and use of technologies in higher education at the universities of the system. This planning must be approached using a global vision that looks beyond the planning of technology infrastructures or that simply acts in response to the typical, rapid changes in access devices and software. This strategic planning must allow for the incorporation of new teaching methods, mainly hybrid ones, based on taking full advantage and educating students in the skills they need to harness the full potential of the Internet as a basis for their future professional activity.

We clearly need to provide training for university students and teaching staff in active and collaborative methods of using the Internet for education purposes. This research classes students and teaching staff as expert users of technology but underlines the fact that they do not apply this expertise to their professional activity (teaching or learning). Training, together with a boost to experiments with innovative practices and methods in education, is the best way of introducing change to the university education system, without forgetting the social education aspect (Web 2.0) of the Internet to guarantee a more extensive and intensive use of its potential. It is also necessary to foster interchange and collaborative work between professionals of the university system so that they can share and exchange learning experiences in innovative methods of education.

One way of promoting the hybrid method in universities with classroom teaching that will efficiently combine the synchrony of classroom teaching with the asynchrony resulting from intensive Internet use is to take advantage of the current process of implementing the ESHE in the university system of Catalonia. This action will have to be accompanied by a boost to joint and collaborative work between the system's universities in order to prepare for the technological changes – free software, platforms, etc. – and educational changes – innovative methods, materials openly available on-line, environments propitious to collaboration, etc. – that use of ICTs, particularly the Internet, will require in higher education.

When analysing the influence of the use of technologies on the academic performance of students, we see that those with greater user expertise and those with a more intense,

non-academic use obtain poorer results in their academic transcripts. This is possibly due to the fact that they spend more time on these uses and have less to spend on more academic ones.

Academic use of the Internet has a double-edged effect on academic performance. On the one hand, we see a positive influence of the Internet as a complementary tool allowing students to become more active, participative and communicative in their studies. The development of tools to enable these uses could play an important role in improving the learning process. Application of social websites or Web 2.0 to teaching methods could be an interesting future formula for improving teaching.

Another aspect of the positive role of ICTs as a complement to teaching is how the change in study habits brought about by use of the Internet has a negative impact on the academic performance of university students when they stop attending class or visiting the library as a result of technologies. Hence, we can confirm that substituting the information received at university by that found on the Internet has a negative effect on performance, though complementing the former with the latter does not.

In contrast, however, having a learning style that is very favourable to the Internet limits the possibility of obtaining more study credits. The explanation no doubt lies in the lack of correspondence between the teaching style of staff and the adoption of a learning style that is more favourable to the Internet by a proportion of students.

Use of the Internet by teaching staff for research is a deep-seated reality. Only 5.67% of teaching staff affirm that they use the Internet little or not at all in their research activities. The most common uses include looking up information for research and publishing the results obtained.

We also see that use of the Internet for communicative group research is fairly common among staff who participate with some degree of intensity in on-line research networks and those who passively receive group information from distribution lists on research. There is a minor active participation in spontaneous virtual communities that do not have institutional backing. Nonetheless, we need to make two points here: firstly, participation in on-line research networks occurs mainly in networks set up by the university, which suggests that the physical barriers of new technologies have not been overcome as much as they could be. The second point is more methodological and concerns the fact that our quantitative study does not measure the intensity of participation in research networks. As a result, we cannot categorically state that this use of the Internet for collaboration purposes is intensive.

The Internet has become a major channel for the publication of research for three main reasons: the prestige of certain on-line journals, publishing ease and the collectivisation and free dissemination of knowledge. Thus, our data suggest that the Internet is used more as a giant warehouse where information can be found and published than as a tool for collaboration.

Because of the changes they have had to make to survive as an institution, university libraries have adapted to the information society and an increasingly globalised educational environment. It is for this reason that university libraries have come a long way from simply being a place where books are stored and organised for later reference; instead, they have assumed new functions, often facilitated by the use of new technologies. One fundamental change taking place for the introduction of the ESHE is the transformation of digital libraries into LRRCs, one that will depend on political will and the investments made. Given that reorganisation would require centralising currently disperse areas into a single body, we can expect the typical resistance associated with organisational change in this respect. The management of this change, together with the investments made, could be the key to their successful transformation into resource centres.

Another important change is the format in which information can be accessed through libraries. Paper is currently making way for digital media in libraries, including virtual formats for which libraries very often limit themselves to being gateways. This situation is mainly seen in the databases of fee-based electronic journals. It is precisely this payment for electronic information that has led to a key change in the way libraries operate; i.e. they have undergone a collaborative organisational transformation. As in other countries, Catalan libraries have had to associate in order to purchase electronic information and access greater volumes of the latter, thus initiating a very advantageous mode of collaboration that has exceeded its initial aim and spread to other areas. The dynamics of this could be extrapolated to other areas of higher education in order to equip the system with an operation that would allow it to adapt to the globalised dynamics of the modern world.

Teaching staff use the on-line services studied (consulting catalogues, consulting databases and available on-line journals, reserving, requesting and renewing borrowing periods, and requesting information and documentation by e-mail from libraries for academic activities) more than students do. Notably, requesting personalised information for academic activities – which is the service most closely related to the operating dynamics of LRRCs of those included in the questionnaire – was the least used service, which shows that the study dynamics of the ESHE have not yet been incorporated into libraries, since they are not yet seen by the university community to support learning, teaching and research. In contrast, the traditional notion of a digital library where content can be accessed in whatever format still prevails.

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