

CAMPUS INFORMATION SYSTEMS FOR UNDERGRADUATE STUDENTS IN SPAIN: A COUNTRY-WIDE CLUSTER CLASSIFICATION

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Abstract

The availability of broad characterizations of campus information systems for students can be useful for the strategic information management of higher education centres. First we describe and contextualize a characterization model for on-line campus information systems for undergraduate students. This serves as a framework of conceptual reference for empirical work on Spanish universities. Information was gathered by means of structured visits to institutional websites and structured interviews with undergraduate students. Analyzing the information collected enables us to classify Spanish higher education institutions into three clusters with homogeneous characteristics, in the sense of their information system and organizational aspects. Finally, we discuss future research on this subject.

Keywords: Campus Information System, Information Resource Evaluation, Information for Students, Strategic Information Management

1 INTRODUCTION

At the end of the 20th century the opening up of information technology and electronic communication radically altered the potential for exchange of information on the university campus. In the first half of the 1990s, there were perceptible changes in the situation on campus (McClure & Lopata, 1996). But it was the common use of the World Wide Web (WWW), from the mid 1990s onwards, which produced a qualitative leap in the potential of on-line information at universities.

The situation of campus on-line information infrastructure before and after the widespread use of the WWW shows two rather interesting features: first, the rapid and random spreading of electronic information resources makes them difficult to manage globally, from a strategic point of view (Long, 2000); and secondly, although the technologies for electronic information were largely invented within

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the university environment, their systematic introduction and use in this environment are neither rapid nor easy (Daniel, 1999). The problem of effective introduction was dealt by Bates (2000).

This research attempts to make a contribution towards obtaining a present view of these topics. The objective of this study is to analyze, through a characterisation model of the campus information system for students, the Spanish situation. The purpose is that it could be useful as much in the area of strategic management as for the orientation of prospective students. Networked information system was considered in the context of on-campus teaching, as an infrastructure to improve the capabilities of the physical campus and not as a substitute for it.

By students we mean undergraduate, in their role as users of the campus information system. We consider the state of the system as far as the university general corporate information resources are concerned, those which are in use.

In order to know the situation with reference to the characterisation model, an empirical work was carried out on Spanish universities (65 institutions, practically the entire higher education system in Spain, with the exception of distance learning universities and those very recently founded).

In the next section we describe and contextualise a characterisation of campus information system for students. Next, we present the results of empirical work conducted on higher education institutions: a cluster classification. Finally, conclusions and possible future research are exposed.¹

2 CHARACTERISATION MODEL OF THE SYSTEM

In order to formulate a conceptualisation and characterisation of campus information systems adequate to the case and context being dealt with, we took into account the state of the art (detailed in Cobarsi, 2005) with respect to three principal areas: first, the theoretical precedents concerning information systems, both those which were of general nature (Checkland & Holwell, 1998; Galliers, 2003; Boisot & Canals, 2004)²; as well as those specific to the university context (McClure & Lopata, 1996; Hanna, 2003)³ secondly, the demands and habits of the students as users of the on-line information system (Brown & Duguid, 2000; Cornford & Pollock, 2003)⁴; and thirdly, the methodological experience of other field studies on universities and information systems carried out on broad groups of higher education institutions (McRae, 1999; Bernstein et al., 2000; Buenadicha et al., 2001).

2.1 Concept of a campus information system for students

With reference to McClure & Lopata (1996), Star & Ruhleder (1996) and EDUCAUSE (2003), we take the following working definition of a **campus information system for students (CISS)**: An interrelated group of content and services, accessible by computer through the campus's institutional website, which a university places at the disposal of its students to enable them to consult it and/or provide a selection of data significant and relevant ready to use in the context of their university life in its academic, administrative and social senses. CISS is important for present students, but it is also important for future students who are looking for information at the website of the institution. As it is described in Veloutsou, Paton & Lewis (2005), different types of students' recruitment exist and

¹ This research was funded by the Spanish Ministry of Education, Culture and Sport (Programme for studies and analysis to improve the quality of the university system) and by the Internet Interdisciplinary Institute www.uoc.edu/in3.

² See also Folkers (2005).

³ See also Marzo, Pedraja & Rivera (2005).

Internet and websites are increasing their importance. For that reason, managing a high performance information system is going to be a competitive factor in the future.

Taking as a reference point the socio-technical concept of information systems (Checkland & Holwell, 1998), it is considered that the existence of contents and services implies the availability of certain technological elements (Kirkwood & Price, 2005) but, in addition, of an adequate organizational environment. Thus, the fact that certain on-line information resources are available to the student user implies their effective adoption by the teaching staff.

2.2 Characterisation requirements

The principle requirements sought to formulate a useful and practical characterisation of the CISS are the following.

First we wished to acquire a characterisation which would allow the presentation of synthetic information. It can be of interest to the managers of the institutions (Davenport & Prusak, 1998; Orna, 2004). The characterisation must make possible to arise a quantitative analysis and to position it in the context of the Spanish university system.

Secondly, to ensure that the data of the model are representative, it is necessary to select a sufficiently relevant and exhaustive group of key characteristics to permit an adequate analysis. It was decided to focus the characterisation on the global usefulness of the system to the user. This is understood both quantitatively, in the sense of the diversity and depth of capabilities provided by the information infrastructure (Ryan et al., 2001), as well as qualitatively, referring to either the orientation or the nature of information provided (Boisot, 1998).

Thirdly, following Codina (2000), the model must be operative and applicable in realistic working conditions.

2.3 General structure of the characterisation model

The model is based on two broad characteristics describing the campus information system for students: information resources and information attributes.

The working definition of an **information resource** is as follows: an element of infrastructure which enables the transaction of certain selected significant and relevant data, prepared so as to provide content and information services that can be used directly by the student. It is necessary to establish some minimum requirements for an element to qualify as a resource. Examples of resources are course information prior to registration and course reading lists.

The concept of an **information attribute** is: The qualitative type of an aspect of the information transactions provided by the resources. Each attribute can be applied to each and every one of the resources and has a finite set of possible values. This implies the definition of certain decision criteria with respect to assigning a value from the group of possible values to a particular attribute. Possible values will be discussed in the next section. Examples of attributes are the level to which the information is structured and the extent to which it can be managed on-line.

2.4 Characterisation model

The model brings together the group of resources and attributes. First of all, a list of 17 key resources was defined, as set out in Table 1. There are 8 with an academic orientation (coded AC-1, etc.), 3 from

an administrative point of view and 6 with a social orientation. The classification of resources in these three areas of university matters comes from EDUCAUSE (2003) and the list is mainly based on the mentioned source and Bernstein et al. (2000). In order to adjust the model to the current situation in Spain, we adjusted the selection of resources and set up a working definition for each one.⁵

Type	Code	Name
Academic	AC-1	Information about subjects prior to registration
	AC-2	Subject-specific website for students from the same class
	AC-3	Library: catalogue
	AC-4	Library: subject bibliographies
	AC-5	Library: document acquisition service
	AC-6	Library: electronic bulletin of specialised news
	AC-7	Library: complaint and suggestion forms
	AC-8	Exam archive
Administrative	AD-1	Financial aid
	AD-2	Registration
	AD-3	Provisional final grades
Social	SO-1	Housing information
	SO-2	Professional information
	SO-3	Directory of professors
	SO-4	Directory of students
	SO-5	Forums

Table 1. Information resources for students

A set of minimum requirements was defined for each resource. In addition, we allowed for a series of optional characteristics the resource might generally possess, to act as a practical guide for the empirical work. For example, for resource AC-1, course information prior to registration, we took as an obligatory requirement that it should include information about the number of credits and the type of course and that the resource should exist in courses for various degree programmes. On the other hand, elements such as the possibility of accessing surveys results about teaching quality, or information on teaching methods, were considered optional.

Besides confirming or not the existence of information resources at each university, it was decided to characterise their attributes. Six attributes were chosen, mainly based on Boisot (1998) and Laudon (2002).⁶ Each of the 6 attributes was applied, with uniform criteria, to each of the 17 resources in every university and its value depends on the configuration of the resource in each individual case. For each attribute, 5 possible qualitative levels were defined:

- Level N: the resource does not exist.
- Level L: the resource exists and the attribute's level is low.
- Level M: the resource exists and the attribute's level is medium.
- Level H: the resource exists and the attribute's level is high.
- Level X: undetermined.

The six attributes are: 1) interactivity, 2) hierarchicalisation, 3) structuring, 4) transactionality, 5) decisionality and 6) communicationality. The first three attributes are indicators of the system's

⁵ We took into account the information gathered in a qualitative study with individual and group interviews to selected Spanish students, from a wide range of universities and degrees. Interviews were semi-structured (Marshall & Rossman, 1994; Morgan & Krueger, 1998).

⁶ As done with resources, we took into account to adjust attribute definitions information gathered in a qualitative study with interviews to selected Spanish students.

general orientation, while the last three measure the variety and depth of the specific utilities which the system offers to the student. Their description is as follows.

- 1) **Interactivity** measures to what extent the student can actively enter into the use of the resource while consulting and/or entering information (based on Berenguer (1997)).

Examples: Course information prior to registration would, in principle, be assigned level L, since this usually consists of a file for passive consultation. If there were an option to ask for further information by email, it would be assigned level H. A forum would be assigned level H because it is by definition open to the active participation of any student.

- 2) **Hierarchicalisation** measures the focus of the resource on the transaction of information between equals (students) or between students and the teaching staff or administration (based on Arribas (2001)).

Examples: The website for a course might be level M (if the student can provide input, directed at other members of the class, by means of a subsection for debate) or level H (if only the lecturer can distribute information to the group, while the students can only read what is sent or published).

- 3) **Structuring** measures to what extent a resource promotes the availability of information in records (and, if applicable, the organisation of these records in controlled fields) for its transaction (based on Boisot (1998)).

Examples: Course information prior to registration would be level H if it includes only controlled fields such as the name of the course, type of course, number of credits or level M if it also included non-controlled fields such as explanations of methodology or aims.

- 4) **Transactionality** measures to what extent a resource is focused on enabling transactions to be carried out on-line (based on Laudon (2002)). By transaction we mean a process involving exchanging or viewing either standard documents or physical objects.

Examples: A registration process with automatic virtual registration would be level H. One with an on-line request for a time to register in person would be level M. If the user can only view information on the regulations or registration periods, this would be level L.

- 5) **Decisionality** measures to what extent a resource is focused on enabling the student to plan and make decisions (based on González (2001) and Laudon (2002)).

Examples: The recommended course reading list is level H, because it offers information useful for a whole course. The library catalogue is level M, because it helps the student to find documents to consult at particular moments, on a short-term basis.

- 6) **Communicationality** measures to what extent a resource is focused on emerging information, such as suggestions, news, opinions or on working as a group (based on Laudon (2002)).

Examples: A discussion forum is level H. A library catalogue would be level M if it includes a list of new acquisitions. Administrative resources are usually level L.

So, the model implies a considerable amount of data on each university: a 17 x 6 matrix. To better understand campus information system of an individual institution, it is useful to synthesise these data. Is for that reason why a cluster analysis was conducted in order to classify universities, as is explained in next section.

3 INFORMATIONAL CLASSIFICATION OF SPANISH UNIVERSITIES

In order to establish the situation in Spanish universities according to the model described, an empirical work exercise was carried out covering the 65 institutions that are at least 3 years old. Fieldwork methodology to collect data is described in Appendix A.1. The results are presented below.

For a better understanding of this research results and conclusions, it is necessary to take into account the general context of the Spanish higher education system.⁷ There are 65 Spanish universities that are at least three years old. A notable feature of the whole group, as far as type of institution is concerned, is that in Spain there are considerably more public universities (49) than private ones, whether secular or religious (16).

In order to classify Spanish institutions into coherent subsets, we applied a multivariate statistical analysis to the qualitative values of all the attributes for all resources of the 17 x 6 matrix informational characterisation model. Also, some paramount organisational characteristics of universities were taken into account such as: property (public, private), geographical distribution by regions, size, foundation date (according to political higher education environment when institution was created). For methodology analysis see Appendix A.2⁸. This allowed us to obtain a group classification of the 65 universities into 3 clusters, designated according to selected highly distinctive features, concerning informational orientation and organisational tipology. The cluster each institution belongs to is noted in Table 2.

- **Cluster 1: Public Interactive.** Made up of 46 universities oriented to interactivity attribute. There is a high proportion of public universities (76.9%), and the remainder are private religious universities (23.1%).
- **Cluster 2: No Man's Land.** Made up of 13 institutions which have no clear tendency towards any attribute for the group of resources. There is a balance of public universities (30%), private secular universities (30%) and private religious universities (40%).
- **Cluster 3: Public Bureaucratic.** Made up of 10 universities which are oriented towards the attributes of hierarchicalisation and structure. This group includes a high proportion of public universities (85.7%) compared with private secular universities (7.1%) and private religious universities (7.1%).

In order to better understand the meaning of these three clusters, we must mention not just significant features obtained but also informational and organisational characteristics which have been taken into account in the proposed model and conducted cluster analysis but have not shown as meaningful in analysis results. Thus, there are just three out of six model attributes that result significant (interactivity, hierarchicalisation and structuring). Neither there are significant groups of resources, such as academic, administrative or social. Public/private is an important and significant organizational feature of clusters. But it was surprising for us that others taken into account showed no meaningful, such as university size, age or geographical region. We tried even with thematic orientation of the institution, although it was difficult to find an objective measure of it and showed no meaningful.

⁷ According to data obtained from the portals: Consejo de Universidades (Universities Council) (<http://www.mec.es/consejou>) and Universia (<http://www.universia.net>) [both consulted on 20th July 2004].

⁸ In addition to that methodology, alternatives are possible to obtain complementary insights, such as a ranking classification (Cobarsí, 2005).

We must point that institutions with interactive attribute orientation, correspond in general terms with universities which have more on-line information resources. On the opposite, bureaucratic attribute oriented institutions use to have less resources. And no man's land attributes orientation matches with an intermediate number of on-line resources. So, it seems that introduction of on-line information begins with a few highly structured read-only information resources, and ends-up with a wider range of interactive resources, after an intermediate and undefined phase. In this sense, each one of the three clusters seems to match, in general terms, with these three phases. It must be noted also that in general terms private institutions have an intermediate position, so they seem to rely on more traditional systems than on-line for exchanging information in campus.

Type	Cluster 1: Public Interactive	Cluster 2: No Man's Land	Cluster 3: Public Bureaucratic
Public	A Coruña	Alcalá de Henares	Complutense Madrid
	Almería	Alicante	Córdoba
	Autònoma Barcelona	Vigo	Huelva
	Autònoma de Madrid		Illes Balears
	Barcelona		Jaén
	Burgos		La Laguna
	Cádiz		Oviedo
	Cantabria		Pablo de Olavide
	Carlos III de Madrid		Pública de Navarra
	Castilla-La Mancha		Rey Juan Carlos
	Euskal Herria		
	Extremadura		
	Girona		
	Granada		
	Jaume I de Castelló		
	La Rioja		
	Las Palmas de Gran Canaria		
	León		
	Lleida		
	Málaga		
	Miguel Hernández		
	Murcia		
	Politécnica Cartagena		
	Politécnica Catalunya		
	Politécnica de Madrid		
	Politécnica València		
Pompeu Fabra			
Rovira i Virgili			
Salamanca			
Santiago Compostela			
Sevilla			
València Estudi Generals			
Valladolid			
Zaragoza			
Private	Camilo José Cela	Alfonso X El Sabio	Católica de Ávila
	Europea de Madrid	Antonio de Nebrija	Deusto
	Mondragón	Cardenal Herrera-CEU	Pontificia Salamanca
	Navarra	Católica San Antonio	
	Pontificia Comillas	Francisco de Vitoria	
	Ramon Llull	Internacional de Catalunya	
	San Pablo CEU	Internacional SEK	
Vic			

Table 2. Universities cluster classification

4 CONCLUSIONS AND FUTURE RESEARCH

The condition of a university campus information system for students (CISS) can be determined, in broad terms, from outside the institution by combining the information that can be seen from the institution external website and that which is available to current students. Thus, leaving aside its global reputation, which may come from many different factors outside the scope of this work, it can be classified as far as the state of its CISS is concerned.

As to the individual information system orientation of the institutions, Table 2 provides a synthesis: it shows in which of the three orientation clusters or groups created by means of multivariate statistical analysis belongs. A 46 universities cluster shows an orientation towards interactivity, which can be seen as positive in general terms. On the opposite, a 10 institutions cluster has a bureaucratic oriented information system, which we envision as a negative situation. Finally, a group of 13 institutions has no defined orientation. These three clusters seem to match in general terms with three phases in introduction of on-line information resources, where the interactive cluster being the more advanced one and on the opposite the bureaucratic cluster in an initial stage. Most of private institutions are placed in the intermediate cluster, so that they have not, in general terms, a pioneer role in introducing on-line information in Spanish campus.

The current study has enabled us to obtain a group view of the information situation in Spanish universities in terms of the general orientation of the system available to the students. This work could serve as a basis for later research on the implementation and/or impact of these systems in individual institutions. Case studies could be carried out on universities, which may be selected taking into account the results presented here.

In addition, and with a view to future characterisation models for a campus information system, we need to distinguish between two types of characteristics. On the one hand, there are those which are minimum or basic necessities, but which produce no advantage because they are, or end up being, short-term in all institutions (for example, on-line registration). On the other hand, there are those elements which can indicate a difference between institutions (such as certain social resources or the configuration of the course website). All these elements are found in the characterisation, which was prepared at a time when many Spanish universities are still in the early or intermediate stages of implementing these systems. But, with a view to the future, we need to make a clearer distinction between those elements which are likely to represent a significant advantage to both, the student and the institution, and those which everyone is keen to incorporate into the system (and could therefore be left out) (Folkers, 2005; Winkvist, 2005). In this respect, the ability of the campus information system to integrate the student into an extensive and diverse network of relationships and personal contacts during his or her time at university and beyond should be taken into serious account as a valuable benefit to offer to the student (Coates, 2005). These are the elements which are found above all in those defined as social resources and in the communicationality attribute, which could be re-thought and re-formulated with a view to the evolution of the model.

Concerning future research, we must also note that the attributes and resources collected in the model were intended to seek points in common for the analysis of a broad group of institutions, while considering a generic student profile. However, they can also serve as a basis for discussion, to define the campus information system that a university would like to have, and the type of students that it wishes to attract specifically. This idea of types of universities and their students fitting in with each other is emphasised in Veloutsou et al. (2004) and is consistent with the need for Spanish higher education institutions to diversify, pointed out in Michavila (2001).

Finally, we must acknowledge that resources available were limited for collecting data into a set of 65 institutions. So, it was not possible for us to collect with detail the differences between schools or centres into the same university, but criteria were set in order to have a general university-wide vision of the information system obtained with homogeneous criteria and systematic procedures across all universities under study.

APPENDIX

More detailed methodology information can be found in Cobarsí (2005).

A.1: Fieldwork collection data methodology

The fieldwork to collect data on the 65 universities was carried out in two phases: first, structured visits to institutional websites and, second, structured interviews with current undergraduate students.

The visits to the institutional websites were done simultaneously by two observers who periodically compared and contrasted criteria and results. A template and documentation were used to establish definitions, criteria and to clear up specific doubts (which arose primarily in the first 10 institutions). As a result of these visits, the values of the majority of the model characteristics was obtained or, if not, recorded as doubtful.

Afterwards structured interviews were held with final-year students from two different centres at each university (one of them was economics-management school and the other one was chosen according to thematic orientation and reputation of each institution). That allowed us to complete, confirm and, in a few specific cases, correct the information collected from the institutional website visits. That was especially useful in relation to resources such as subject-specific course websites (AC-2), normally not accessible from outside the university network. Restrictive criteria were used so that when there were discrepancies among students, the entire university was assigned the most unfavourable value.

A.2: Multivariate statistical analysis methodology

The multivariate analysis consisted of two phases: first, multiple correspondences analysis (Benzecri, 1973; Greenacre, 1993) and, in a second phase, cluster analysis (Aldenderfer & Blashfield, 1984).

The analysis of multiple correspondences aims to synthesise the information from the 17x6 qualitative variables (combinations of attributes and resources) in a few numerical axes. An analysis was made for each attribute and two interpretable axes were found. They explained between 32% and 59% of the corrected inertia according to the formula of Benzecri (1979). The still unconfirmed resources were treated like “missing” data according to the method proposed in Zárrega & Goitisoló (1999) and implemented with standard software in the way suggested by Coenders et al. (2002).

Cluster analysis aims to find groups of universities with similar informational and organisational features and was done with the complete linkage method, also known as the farthest neighbour method, using the squared Euclidean distance. The analysis was repeated using Ward’s method and 91% of the universities were identically classified.

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