Business Computing - A Shared Curriculum Proposal for the Spanish-Portuguese Border under the Auspices of the New European Higher Education Area

Francisco J. García[1], José A. Gomes [2], Luis Alonso[3], Luís A. M. Amaral[4] and José L. Pérez[5]

Abstract **- The Bologna Declaration is leading to a change of paradigm in the context of higher education in many countries of the European Community; it has a significant impact at the level of curriculum and learning models. Therefore, any reflection and decision work on the processes of teaching/learning imposes the curricular reformulation of higher courses in an innovating way, supported by new references and assumptions. In the context of a project financed by European Community program Interreg III A, we have created a workgroup to o propose the reformulation of several courses that belong to Business Computing, from ESTiG-Portugal and from ESPZ-Spain, in an attempt to create harmony between both study plans, considering the socio-economic specific context of the border region between Bragança (Portugal) and Zamora (Spain). This article intends to describe a case-study related to the work done to achieve a curriculum for Business Computing; it describes the changes due to the recent recommendations of Bologna and governmental reflections of Portugal and Spain.**

Index Terms - Bologna Declaration, Business Computing, Curricula guidelines, European Higher Education Area.

INTRODUCTION

The Bologna agreement, signed by the European Ministers of Education on June 1999, establishes the basis for a European Community Higher Education System that should be operational before 2010 [11].

This new European Higher Education Area (EHEA) is based on a clearly defined common goal: enhancing the employability and mobility of citizens and increasing the international competitiveness of European higher education. In order to fulfill this main goal, a set of specified objectives are defined [4, 11, 18]:

1. The adoption of a common framework of readable and comparable degrees, also through the implementation of the Diploma Supplement. The Diploma Supplement is a document attached to a higher education diploma providing a standardized description of the nature, level context, content and status of the studies that were pursued and successfully completed by the graduate. This supplement provides transparency and facilitates academic and professional recognition of qualifications.
2. The introduction of undergraduate and postgraduate levels in all European countries, with first degrees no shorter than three years and relevant to the labor market.
3. The adoption of an ECTS (European Credit Transfer System) also covering lifelong learning activities. A credit system is a systematic way of describing an educational program by attaching credits to its components. The ECTS is student-centered, based on the student workload required to achieve the objectives of a program, being those preferably specified in terms of learning outcomes and competences to be acquired. ECTS is based on the convention that 60 credits measure the workload of a full-time student during one academic year. The student full-time study program in Europe amounts to about 36-40 weeks per year so that one credit stands for 24-30 working hours.
4. The promotion of a European dimension in quality assurance, with comparable criteria and methods.
5. The elimination of remaining obstacles to the free mobility of students and teachers.
6. In order to further strengthen the important European dimensions of higher education and graduate employability, is important to increase the development of modules, courses and curricula at all levels with European content, orientation and organization. This concerns particularly modules, courses and degree curricula offered in partnership by institutions from different countries and leading to a recognized joint degree.

[1] Francisco J. García, University of Salamanca, Computer Science Department, Faculty of Sciences, Salamanca, 37008, Spain, fgarcia@usal.es
[2] José A. Gomes, Technical and Management College of Bragança, Portugal, adriano@ipb.pt
[3] Luis Alonso, University of Salamanca, Computer Science Department, Faculty of Sciences, Salamanca, 37008, Spain, lalonso@usal.es
[4] Luís A. M. Amaral, University of Minho, Portugal, amaral@dsi.uminho.pt
[5] José L. Pérez, University of Salamanca, Computer Science Department, Politechnical College of Zamora, Spain, jpi@usal.es

0-7803-8552-7/04/$20.00 © 2004 IEEE **October 20 – 23, 2004, Savannah, GA**

7. Defining scholarship programs for students from third countries should reinforce the attractiveness and openness of the European higher education.
8. Higher education has to make lifelong learning a reality. Such action must be an integral part of higher education activity. It is necessary to stress the need to improve opportunities for all citizens, in accordance with their aspirations and abilities, to follow the lifelong learning paths into and within higher education.

Formally, the EHEA appears for the very first time in the Sorbonne Joint Declaration on May 1998 [16]. This declaration proposes a mechanism to strengthen a Knowledge Europe. The four signatories of the Sorbonne Declaration are turned into twenty-nine in the Bologna Declarations. But it is important to stress that the road to this ESHE has several outstanding antecedents (such as Jacques Delors' report for the UNESCO [7] or the report for the United Kingdom National Committee of Inquiry into Higher Education [6]) and its successors (such as the Prague communiqué [10], the Salamanca message [1] and the Berlin communiqué [4] for example).

Computer Science studies in Spain have been selected within the head group of studies that will be first to adapt to the Bologna guidelines. In this sense, several initiatives, working groups and proposal have been started in order to face up to this future that is heading towards us at a tremendous speed.

The most important action related to the Computer Science studies in Spain is the EICE project, which is supported by the National Agency for Quality Assurance and Accreditation (ANECA). Its main goal is the creation of a survey on the design of curricula for the official undergraduate studies on Computer Science adapted to the EHEA, and also the writing a White Book about these studies.

Besides, other minor initiatives have taken place. One of these proposals has been jointly developed by the University of Salamanca (Spain) and the Technical and Management College of Bragança (Portugal). In this case, the objective was the development of a Bologna-compliant curricular proposal (specially based on objectives 5 and 6, explained above), to be applied to *Business Computing* or *Information Systems*, which will be taught in the central border zone between Spain and Portugal, since it shares a common socioeconomic reality. The academic centers that will support the proposed curriculum are the Technical and Management College of Bragança in Portugal and the Polytechnic College of Zamora in Spain (the last one belongs to the Zamora campus of the University of Salamanca), these cities being 100 Km apart from each other.

This paper is devoted to present this curricular proposal at the architectural level. The rest of the paper is organized as follows. Section 2 explains the context of this proposal, underlining the existing socioeconomic reality that invites the formation of graduates with a shared profile. Section 3 justifies why a business Computing curriculum has been chosen. Section 4 presents the curriculum structure. Finally, Section 5 provides remarks and proposes further work.

CONTEXT OF THE PROPOSAL

In order to understand the genesis of this proposal, its triggers should be introduced. These can be categorized in Bologna-based guidelines and socioeconomic aspects. The former will be treated in Section 4, when the general framework of the curriculum is introduced, and the latter will be described now.

The orientation of this curriculum proposal towards Business Computing is neither gratuitous nor arbitrary. It responds to the socioeconomic reality presented by the region formed by the western border of the Castile and Lion region of Spain (provinces of Salamanca and Zamora) with the Portuguese region of Trás-os-Montes.

The business world of these regions is clearly described by the commercial activities that mean between 32% and 38% of their companies. It also important to stress that half of the Portuguese enterprises presented in this region are not related to information systems, whereas this value in Castile and Lion region rises to 60% of the total number of companies. In the overall studied region, approximately 95% of the enterprises have less than 10 employees [17], which shows the fragility of its industrial structure. Besides, the GDP per inhabitant in Castile and Lion is 76% of the GDP observed for the overall European Union, and it is 66% in the northern region of Portugal [17].

In order to enhance the economy of this depressed region, a strategy working-plan has been elaborated by the Technical and Management College of Bragança (Portugal) and the Polytechnic College of Zamora (Spain). This plan includes the design of a curricular proposal for Computer Science studies with a Business Computing profile. The result of this curriculum must be a set of highly qualified graduates, who should be quite capable of creating their own small and medium enterprises, using the technological and business base acquired in their studies.

BUSINESS COMPUTING ORIENTATION

In the previous Section we have exposed the socioeconomic reasons that lead us to orientate the curriculum towards the Business Computing or Information Systems.

Nevertheless, there are other important considerations that support this decision. The most outstanding ones are as follows:

- Nowadays, there exist degrees, one in Bragança and one in Zamora, which are oriented towards Business Computing. This situation makes it easy to define a shared curriculum that promotes the mobility of students and teachers, as the Bologna Declaration recommends [11].
- There already exists an important tradition of studies of Information Systems in Europe, EEUU and Canada.
- There are several curricula recommendations supported by prestigious international organizations such as ACM (Association for Computing Machinery), AIS (Association for Information Systems) or AITP (Association of Information Technology Professionals),

whose more interesting results are the well-known curricular guidelines IS'97 [5] and IS 2002 [14].

- There exists an important research effort on Information Systems.
- There are several international conferences whose topics are related to Information Systems, such as ICIS (International Conference on Information Systems), ECIS (European Conference on Information Systems) or CAISE (Conference on Advanced Information Systems Engineering).
- There are several international journals specialized on Information Systems topics such as Information Systems Journal, European Journal of IS or MIS Quarterly.

CURRICULUM STRUCTURE

The development of a curricular proposal, which integrates contributions form different countries, must solve different constraints derived from the legal guidelines of each country, including compliance with the Bologna framework as an added restriction in the presented case. The proposed study program has been jointly developed by a Spanish-Portuguese working-group in which there are members from the University of Salamanca in Spain, from the Technical and Management College of Bragança and from the University of Minho, the last two in Portugal.

The roots of this proposal are based on the following hypotheses:

- The curriculum is undergraduate-oriented. It will comprise four academic years, i.e. 240 ECTS. This means eight semesters with a uniform distribution of 30 ECTS per semester.
- The structure and contents of the study program should promote the mobility of students and teachers between the involved centers.
- The study program curricular basis is Information Systems oriented. In This way, two main goals are achieved. Firstly, we are reusing an important experience derived from the actual Business Computing profile that the Computer Science studies have in the both centers. Besides, the body of knowledge covered by this curriculum proposal should allow the development of information systems as support of mainly technological-based business [14].

In order to fulfill these requirements, the Information Systems can be studied from a systemic perspective (see Figure 1) that recognizes the information system function as a well-defined organizational intervention space in which specialized abilities are required in the Information Systems, Computer Science, Organization and Management domains. This way, a better use of the available resources is possible, thus facilitating the definition of technology-based strategies and the improvement of overall organization performance [13].

Figure 1 shows the systemic approach presented above as applied to Information Systems, in comparison to the Cartesian view of Keen [15]. In this figure three dimensions are shown. The first one is the **Strategic Dimension** that combines the Organization and Management processes with the Computer Science, giving as result the action planning. The second dimension is the **Technological Dimension** that combines the Computer Science with the Computer Engineering, giving as result the development of the information systems. The third one is the **Functional Dimension** in which the information systems are exploited combining the Computer Engineering with the Organization and Management processes.

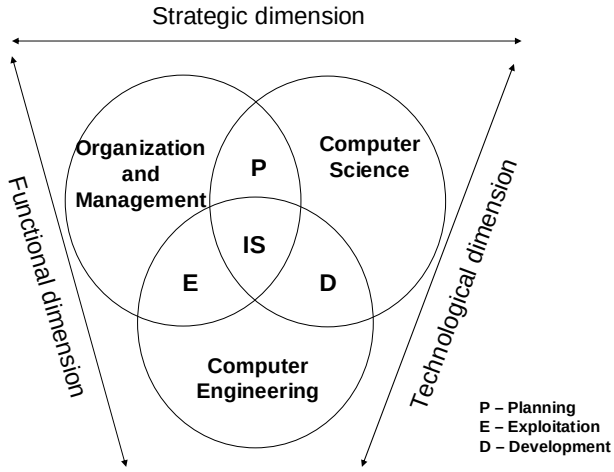

FIGURE 1
INFORMATION SYSTEMS SYSTEMIC MODEL.

I. Curriculum General Framework

The systemic view represented in Figure 1 expresses that Information Systems receive influences from all four main relevant areas for their professionals: *business fundamentals, technology, social skills* (communication ability, teamwork ability and so on), and *strategic ability*, as can be seen in Figure 2.

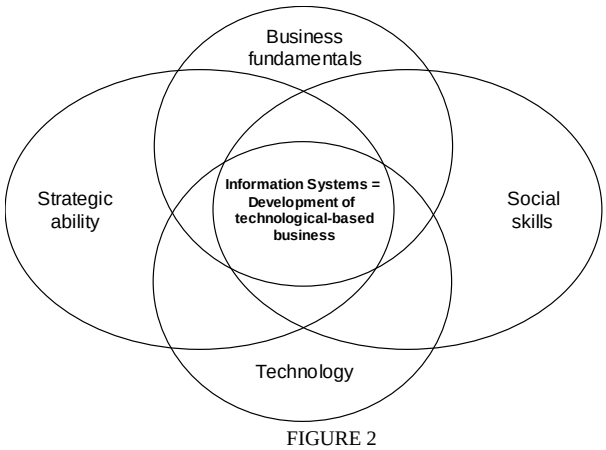

FIGURE 2
INFORMATION SYSTEMS INFLUENCE AREAS, ADAPTED FROM [14].

In order to achieve the training reflected in Figure 2, a study program has been elaborated where subjects are distributed in three main structural blocks:

- *Mathematics and Quantitative Methods:* It is a fundamental block of knowledge for the future graduates.

Besides, in the current proposal this block should offer the basis for the qualitative and quantitative techniques that will be used in the studies.

- *Organization and Management:* It covers the economic and financial aspects, but also social skills and management techniques and tools. These characteristics are essential for the management of the commercial, industrial and public organizations.
- *Information Systems and Information Technologies:* It presents its contents classified in three different abstraction levels (Basic, Structural and Instrumental). This block can be divided in three sub-domains: *Computer Engineering*, *Computer Science* and *Information Systems*.

The *Computer Engineering* sub-domain deals with computation aspects closer to hardware, such as the functional components of a computer, communication systems and their connective properties, or operating systems related aspects.

The *Information Systems* sub-domain is the center of the curriculum, focusing on the management of computer systems and of their resources. The management of information and knowledge are key aspects in this context; for this reason, subjects such as databases, the study of the different information management systems configurations, strategy and technologic innovation, are fundamental for the proposed study program.

The *Computer Science* sub-domain provides the entire knowledge basis for information technologies and software development. Computing has a broad spectrum, which extends beyond that of Computer Science [9]; in this case the computation perspective should be the basis for curriculum centered on Information Systems. For an Information Systems professional, it is essential to have a strong knowledge about software systems development, which should take into account all the software life-cycle stages. Two are the disciplines more directly related to this proposal. The first one is *Programming Foundations*, which has been traditionally included into the Computer Science body of knowledge [9]. The second one is *Software Engineering*, which also appears within the Computer Science body of knowledge [9], but lately Software Engineering is being considered as an independent curricular entity with deep Computer Science and Mathematics roots. In this sense, a Software Engineering body of knowledge [2] has been defined, and a first public draft of the Computing Curriculum on Software Engineering [8] has been published jointly by IEEE-CS and ACM.

Once the structural blocks are defined, a temporal framework should be established.

The proposed undergraduate curriculum comprises four years (eight semesters). Translating it to ECTS measurements, it means the global sum of 240 ECTS, 60 ECTS per year, and 30 ECTS per semester.

Taking as an approximation one ECTS per 24 working hours and 18 weeks per semester, a semester means 720 working hours and a week means 40 working hours.

If we have 10 subjects per academic year, i.e. 5 subjects per semester, we achieve a homogeneous set of 6-ECTS subjects. Each subject requires a total of 144 working hours, and 8 working hours per week. This proposal is summarized in Table I.

TABLE I
TEMPORAL DISTRIBUTION OF THE PROPOSED CURRICULUM STRUCTURE

Undergraduate studies	240 ECTS
4 academic years	60 ECTS per year
8 semesters	30 ECTS per semester
5 subjects per semester	6 ECTS per subject
Effort	4 hours of lectures and/or laboratories
	2 hours of guided study
	2 hours of extra work

At this moment we have the general framework of the curriculum. The next step is to decide the concrete subjects that are going to fill this framework. This can be achieved by various means and can make use of different curriculum designs. However, we must satisfy the interests of Spain and Portugal in order to obtain a compatible curriculum.

at this point is where the working group has found the most serious lack of definition. Portugal has just a set of recommendations expressed by the CRUP (*Consejo de Rectores de las Universidades Portuguesas* – Council of Portuguese Universities Rectors). However, Spain differentiates between compulsory subjects (shared by all universities) and optional subjects (chosen by each university; at this time we do know that the number of compulsory subjects will represent between 60% and 75% of the overall ECTS of the studies, but we do not have a more specific definition.

Thus, in order to make our proposal, we have taken into account the CRUP recommendations, Spain's actual three-year program of Business Computing and the recommendations of the Career Space [3]. Table II presents the Career Space recommendations, while Table III represents the Spanish and Portuguese recommendations jointly with our proposal.

TABLE II
CAREER SPACE RECOMMENDATIONS [3]

- A scientific base of 30%
- A technology base of 30%
- An application base and systems thinking of 25%
- A personal and business skills element of up to 15%

TABLE III
NATIONAL RECOMMENDATIONS AND PROPOSAL

	Spanish Compulsory Subjects for Business Computing		CRUP		Proposal	
	%	ECTS	%	ECTS	%	ECTS
Mathematics	11,5	27	15	36	17,5	42
Organization & Management	5	12	25	60	27,5	66
Information Systems	7,5	18	30	72	25	60
Information Technologies	7,5	36	30	72	30	72
	38,75	93	100	240	100	240

Figure 3 shows our curricular proposal, which consists of 40 subjects classified in the following way:

- Seven subjects related to Mathematics and Quantitative Methods. There exists a growth in percentage of this group in order to adequate the overall curriculum to the Spanish load in Mathematics related subjects, which is higher than in Portuguese recommendations.
- Eleven subjects related to Organization and Management. This point represent the greatest effort in order to adequate the Spanish curriculum, and we will have to do it using the optional subjects.
- Six subjects related to Computer Engineering.
- Six subjects related to Computer Science.
- Ten subjects related to Information Systems.

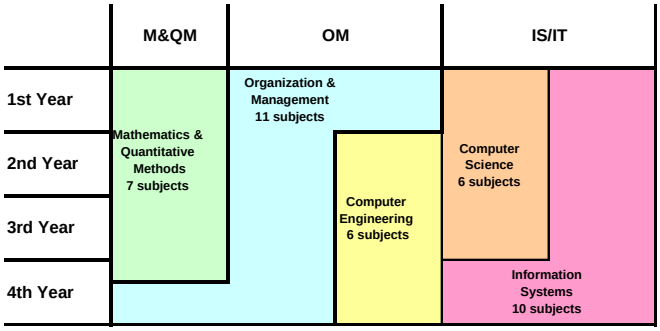

FIGURE 3
STRUCTURE FOR THE BUSINESS COMPUTING BASED CURRICULUM

II. Concrete Subjects for the Curriculum: A First Approach

In order to complete the framework shown in Figure 3, a first proposal of concrete subjects has been defined. Our main goal has been to develop a first study program draft that will be firstly introduced in the Technical and Management College of Bragança (Portugal) at October 2004, and later in the Technical College of Zamora (Spain).

This draft definition is presented in Figure 4.

		Scientific Areas	BUSINESS INFORMATICS CURRICULUM PROPOSAL		
		Mathematics & Quantitative Methods	Organization & Management	Information Technologies and Systems	
				Computer Engineering	Computer Science	Information Systems
1st year	1º S	Mathematics I T=2 P=2 T/P=0	Linear algebra T=2 P=2 T/P=0	Financial accounting I T=0 P=0 T/P=4	Programming I T=2 P=2 T/P=0	Computing fundamentals T=2 P=2 T/P=0
	2º S	Mathematics II T=2 P=2 T/P=0	Discrete mathematics T=2 P=2 T/P=0	Financial accounting II T=0 P=0 T/P=4	Programming II T=2 P=2 T/P=0	Information systems fundamentals T=0 P=0 T/P=4
2nd year	1º S	Statistics T=2 P=2 T/P=0	Management accounting T=0 P=0 T/P=4	Computing Systems T=0 P=0 T/P=4	Object-oriented programming T=0 P=0 T/P=4	Database I T=0 P=0 T/P=4
	2º S	Operational invetigation T=2 P=2 T/P=0	Economics T=0 P=0 T/P=4	Computer networks T=0 P=0 T/P=4	Algorithms & data structures T=0 P=0 T/P=4	Database II T=0 P=0 T/P=4
3rd year	1º S	Marketing T=0 P=0 T/P=4	Financial Management T=0 P=0 T/P=4	Operating systems I T=0 P=0 T/P=4	Software engineering T=0 P=0 T/P=4	Multimedia T=0 P=0 T/P=4
	2º S	Organization & management T=2 P=2 T/P=0	Investment analysis T=0 P=0 T/P=4	Operating systems II T=0 P=0 T/P=4	Software engineering laboratory T=0 P=0 LAB=4	Human-computer interaction T=0 P=0 T/P=4
4th year	1º S	Psycho-sociology of the organizations T=0 P=0 T/P=4	Management project T=0 P=0 LAB=4	Communication services T=0 P=0 T/P=4	Services & comp. Applications administration T=0 P=0 T/P=4	Strategy & innovation in IS T=0 P=0 T/P=4
	2º S	Simulation T=0 P=0 T/P=4	Law T=0 P=0 T/P=4	Network management T=0 P=0 T/P=4	Informatics project T=0 P=0 LAB=4	Information systems management T=0 P=0 T/P=4

FIGURE 4
DETAILED STRUCTURE FOR THE BUSINESS COMPUTING BASED CURRICULUM.

It is open for discussion why some courses presented in Figure 4 are included and why others are not. The specific courses have been chosen taking into account these priorities:

- The information system orientation of the overall curriculum.
- The existing courses in the actual curriculum of Information Systems at the Technical and Management College of Bragança.
- The existing courses in the actual curriculum of the Technical College of Zamora.
- The goal of achieving a future compliant curriculum in both of the involved organizations.

CONCLUSIONS

The creation of a European Higher Education Area, under the Bologna guidelines, is an unstoppable process that is going to change our understanding of the European University.

These changes will affect the configuration of the studies, the composition of study programs, the way that teachers and students understand the learning process, and the mobility and interchange possibilities.

This paper has set out a Business Computing curriculum proposal fully compliant with this European Higher Education Area. This approach has been developed by a Spanish-Portuguese working group, looking for the application of this curriculum in both sides of the border between Spain and Portugal, specifically in the regions of Castile and Lion and Trás-os-Montes, respectively.

Although this proposal is not completely defined, due to the actual lack of definition in some aspects of this process in Spain, its framework can be described as very successful, and we can conclude that we have a first study program proposal for a Business Computing curriculum that allows:

- Satisfying the socio-economic requirements that appear in the referred region.
- Promoting the mobility of students and teachers that belong to the involved centers that will have study programs that will share the same goals and principles. This way, students easily will be able to take part of their study program in both countries, enriching themselves with other culture and different courses or approaches. Teachers can collaborate and participate actively in the study programs of the other side of the border.
- Achieving a solution for the University of Salamanca in order to have two Computer Science study programs, one Software Engineering oriented in the Salamanca city campus, and other one Information Systems oriented in the Zamora city campus.

ACKNOWLEDGMENT

This study was partly financed by the European Union with INTERREG III A funds.

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