

E-learning *Curricula* Search in Geographical Information Systems and Science

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SUMMARY

This paper addresses the process leading to curriculum revision in post-graduate studies of GIS&Sc within the ISEGI-UNL. The project aims to determine an e-learning curriculum proposal, able to provide an answer to a set of challenges of different nature.

The proposed framework suggests the need to consider the current process of curricular revision according to: the major reforms taking place in higher education leading to the implementation of the Bologna Process; the recent context of technological and knowledge progress in GIS&Sc, and finally, the perspective of exploring the models and methods of distance learning already in use, in particular e-learning tools.

The implications of this framework have led to the adoption of a bottom-up approach, with more or less significant repercussions in the curricular revision process. The followed methodology resulted in the construction of a database that will support the search for an e-learning curriculum in GIS&Sc, both in the teaching and learning perspectives.

KEYWORDS: Education; E-Learning; Core Curriculum; Optional Curricula; Geographical Information Systems and Science (GIS &Sc).

INTRODUCTION

The MSc in GIS&Sc

Since February 2002 the Institute for Statistics and Information Management of the New University of Lisbon (ISEGI-UNL), a member of the UNIGIS network, offers a postgraduate course leading to a Master and Postgraduate degree in Geographical Information Systems and Science (GIS&Sc). This course takes advantage from the know-how acquired in several years of GIS teaching (Painho, 1999) and is exclusively delivered through the Internet. It is organized in two parts: curricular (with two mandatory attendance seminars, which may be replaced by a videoconference) and a dissertation. Presently the curricular part of the course is composed by the following disciplines:

1st Semester

- GIS & Science;
- Spatial Data Models;
- Databases;
- Cartographic Sciences;
- GIS Applications I.

2nd Semester

- GIS and modelling;
- Geospatial Data Mining;
- GIS in Organizations;
- Remote Sensing;
- GIS Applications II.

The curriculum reviewing

After the first edition of the course a quality assessment was performed in order to get a clear idea of the results up to that moment, and a general evaluation of the course could be made (Painho, *et al.*, 2002; 2003). Even though this external survey led to an improvement of some less satisfying aspects (mainly concerning the technological aspects of the platform), to this day, the curricular program of the course has not yet been the object of a systematic revision process.

The project now being introduced is based on the conviction that new and important challenges would determine the establishment of a broad and in depth approach to the curricular revision process of the post-graduate studies in Geographical Information Systems and Science. Thus, the analysis framework of this methodological proposal of curricular revision has been established around three major analysis domains:

1. Evaluating the implications stemming from the implementation of the Bologna Process, especially concerning:
 - a. The two most important measures for systematic academic recognition and periods of studies: European Credit Transfer System (ECTS) and Diploma Supplement;
 - b. The promotion of lifelong learning;
 - c. The adoption of measures in order to ensure the academic quality and external systems of evaluation and accreditation.

2. Identification of the fundamental topics of Geographical Information Systems and Science based on the assumption that the definition of a broad curriculum, independently of the meaning given to the acronym, requires the specification of different questions raised by GIS uses. In this sense, and as put forth by Forer e Unwin (1999) the challenge is that the current curricular revision may consider, in a broad way, the major topics connected with:
 - a. the technological aspects related to the acquisition and management of spatial information (the arena of *GISystems*);
 - b. the underlying conceptual issues of representing data and processes in space-time and the conceptual underpinnings of the use of geographical data (the arena of *GIScience*) and;
 - c. the social, legal and ethical context of GIS operation and implementation (the arena of *GISudies*).

All these issues have played a central role in the new approaches to GIS&Sc teaching. The discussion on the implications that arise from these issues, i) have created the conditions for the establishment of a more friendly environment for theoretical analysis in Geographical Sciences, ii) have influenced how and what is taught, and iii) have contributed to the integration of the spatial component in different areas of knowledge.

3. Exploring the opportunities and limits associated with the use of new information and communication technologies in education. This approach does not intend to confront the attendance model of teaching with that of the distance one, but instead, assess the main challenges that occur in the process of curricular revision, focusing on the following aspects:
 - a. The way new methods of teaching and learning may restrict the instructional design process;
 - b. The manner in which new strategies for e-Learning teaching allow the understanding of specific necessities and the educational perspectives within

- different institutional contexts. Which means, to explore the development of educational environments that take into consideration a certain amount of interoperability;
- c. And, in the end, evaluate the implication of these strategies in the conception and development of educational resources of high quality in the GIS&Sc education, so that the bases of the course may translate into pedagogical concepts and relevant experiences.

METHODOLOGY

The framework previously presented has enabled the establishment of a conceptual frame and the definition of the main problem axes that the curricular revision of the post-graduate course on Geographical Information Systems and Science entails. The developed methodology translates the solutions that respond to the challenges and opportunities identified. In the first step of the project a bottom-up approach was adopted, based on an extensive bibliography research that allowed for the reunion of a number of fundamental topics related to knowledge in GIS&Sc. This process led to the identification of the compulsory units, which will constitute the core curriculum of the post-graduate course in Geographical Information Systems and Science (compulsory core units), as well as the units, which although not part of the core curriculum (specific units), will, nevertheless allow in the near future, the building of diversified *curricula* that meet the expectations and needs in education and training in the area of GIS&Sc. The results accomplished in this stage will be measured against the current studies program so that the main redundancies and lapses may be identified, allowing for a first evaluation of the current curricular program, both concerning structure and contents.

In a later stage the joining of the different units will be made, aiming to identify the core and elective modules and, afterwards, the disciplinary areas that should be a part of the new curriculum in e-learning in GIS&Sc.

One of the objectives will be to evaluate the capacity to build optional *curricula* in the course of the constitution of new disciplinary areas subordinated to different theories and curriculum conceptions, under the assumption that a new pedagogical framing may assist in the translation of the fundamentals of the discipline into concepts and relevant pedagogical experiences. The need for this process to be founded on solid theoretical knowledge in development and *curricula* conception is recognized.

The proposed conceptual framework tends to diverge from the top-down design approach recently adopted by a number of important projects linked to the conception and development of e-learning curricula in higher education, such as the InterGIS Project (Strobl and Shahanawaz, 2005) or the Model Curricula Project GI S&T Body of Knowledge from UCGIS (Marble, D. *et al.* 2003). Yet, not minimizing the important results already achieved by these projects, the intention is, in the near future, to confront the new curricular structure of the post-graduate course in GIS&Sc with the curricula proposed by these organizations in order to identify the main differences and if possible the validity and pertinence of the proposed bottom-up approach (*Figure 1*).

Finally, special attention will be given to the Research Agendas from the following organizations: UCGIS, AGILE, NCGIA/Varenus in an attempt to include emerging themes in the new GIS&Sc *curricula* proposal.

RESULTS

Once the general methodology for the curricular revision process was established, a database was developed in order to support the organization and management of a vast amount of information collected in the first stage of the project, as well as to enable a set of tasks to be performed in subsequent stages. Thus the current database structure tries to provide an answer to the necessity of linking a vast amount of information in order to elaborate different units (and their subsequent aggregation into modules and disciplinary areas) which will embody the new curricular proposal on Geographical Information Systems and Science. The database structure tries to focus on some of the

areas of interest mentioned before, especially through the identification of the information requisites that help the implementation of the Diploma Supplement and the attribution of the ECTS to the different curricular units.

Regarding the curricular development, the database design enhances an integrated and articulated vision of the different areas that underlying this *curricula* concept, as well as its evolution or revision in accordance to the bottom-up approach (Figure 2).

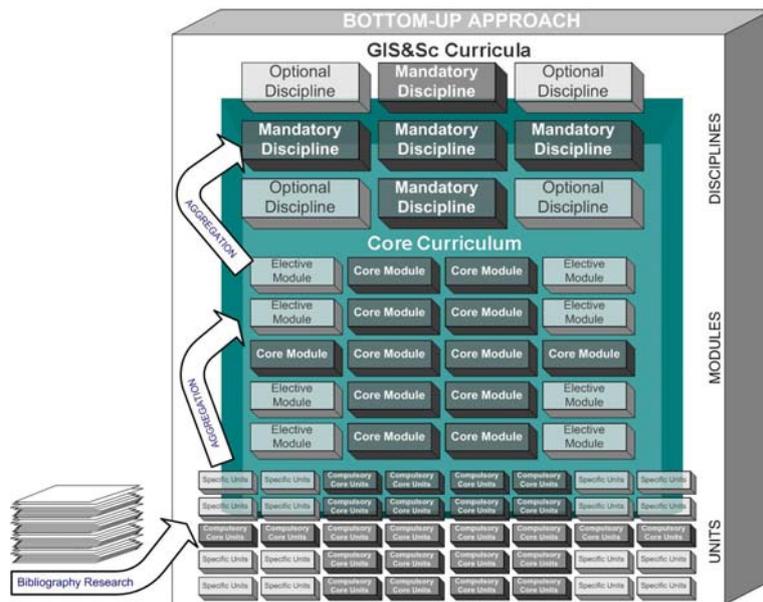


Figure 1 – e-Learning Curricula search in GIS&Sc – A bottom-up approach.

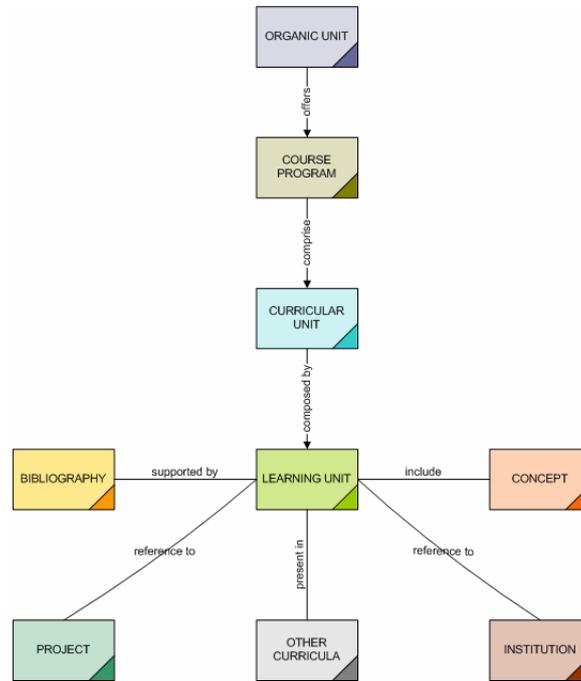


Figure 2- Conceptual database scheme for the curricular revision process in the post graduate course in GIS&Sc

Thus the database conceptual model tries to reflect the current proposal of *curricula* revision and organization in the post-graduate course in GIS&Sc. Subsequently a Web site was developed aiming at the access to the information stored in the database. In this phase of the project the portal offers only the basic functions allowing for the management of the information gathered in the first stage of the project (*Figure 3*).

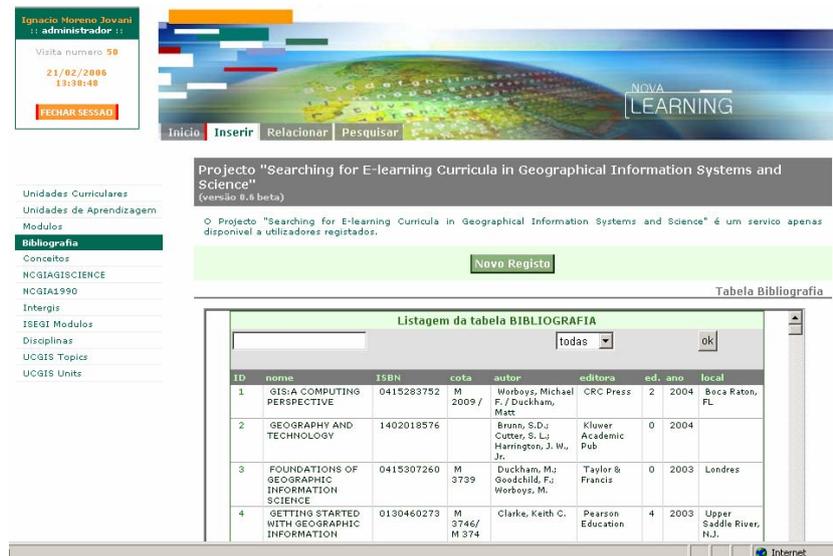


Figure 3- The Website interface design

The development solution for this project was based on the use of open source technologies: Apache server 2.0.55, with SSL security, a database server with MySQL 5.0.15, and a PHP 5.0.5 interpreter (Figure 4).

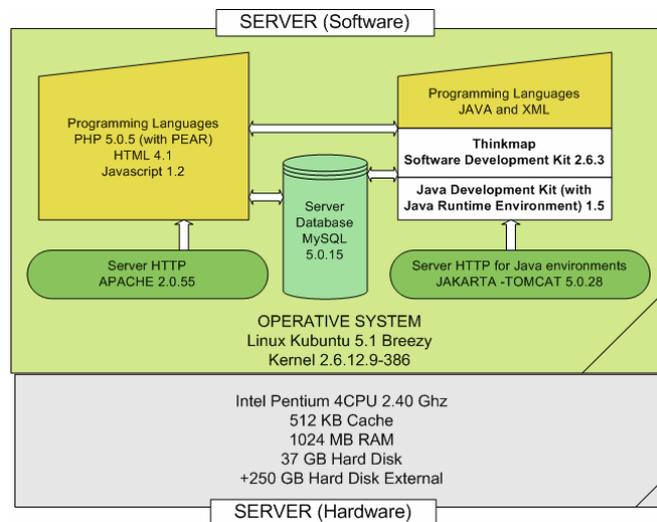


Figure 4-Technological Architecture Solution for Hardware and Software.

The option for the development of a Web solution proceeded from the need to ensure that the faculty of the post-graduate course in GIS&Sc would have a set of adequate tools to organise, structure and put to practice their courses. Amid the current curricular revision process, the commitment to develop a far reaching e-learning curriculum, which tries to be an answer to the challenges that lifelong learning represents, means that using Web technologies should not be limited to the processes of production, management, and course delivery, but should also be used in the student's perspective of

trying to find the most adequate course for his own expectations and characteristics. Finally, the rapid scientific and technological advances of Geographical Information Systems and Science forces the recognition that the revision process now underway should stand for a degree of systematization and ability that puts in practice and ensures the continuity and evolution of the process. Thus, the value of the Open Source solution is taken into consideration and the type of set up of this methodology enables other institutions to join in and contribute.

CONCLUSIONS AND FURTHER DEVELOPMENTS

This project aims to establish a proposal for e-learning *curricula* in post-graduate studies in GIS&Sc able to respond to a set of challenges of a different nature, which encapsulate some opportunities, but also some threats. In the current stage of revision of the e-learning post-graduate courses in GIS&Sc it is not yet possible to have results on the quality of the curricular revision process, especially concerning the adequacy of the proposed methodology, and the quality of the new post-graduates studies program in Geographical Information Systems and Science. However, the framework for this project suggests the opportunity for a more effective exploration of the results, which tend to highlight the benefits of adopting a bottom-up approach in the scope of this project. Some of these outcomes will derive from activities to be developed, which are:

- To confront the current courses plan on GIS&Sc, with the results obtained after the definition of the new broad spectrum *curricula* proposal's integrating units;
- To assess the possibility of defining alternative *curricula* based on the set of identified topic units;
- To confront the new e-learning *curricula* proposal in GIS&Sc with the results obtained in projects developed by other organizations;
- To explore the potential offered by emerging trends in business information visualization in order to access the information assembled during this project.

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