

EDUCATION FOR GIS IN SPAIN : A BIBLIOGRAPHICAL REVIEW

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Abstract: Handbooks published in Spain for education, training and continuous education in cartographic modelization.

Until recent dates, among Spanish scholars the time gap between outside scientific and technological developments and their indigeneous application has been considered a commonplace. This is not the case in digital cartography and GIS applications. The new digital procedures for cartographic modelization shows a fast difussion in last years, similar to that occurred in the core countries. Professional teams in spatial studies in one side, and university researchers in other, are in the spreading wave's crest. Recently Gould [15] has selected writings of four geographers, five engineers, four physicists, plus one philologist, one geologist, and one architect only in the domain of applied works and land public management. It is a very small sample, but representative of the GIS professional spectrum in Spain.

It is not surprising the academic diversity extraction of GIS practitioners, since its introduction in earlier seventies [7,17]. From this remote dates, in terms of GIS temporal scale of development, until today curricular diversity has been very positive for encouraging ideas but negative to working methodology structuration. Further on, the adoption of GIS training courses in the graduated university curriculum in several specializations that misleading and poor productive way can overcome. But it is a recent fact. I would should divide the grow till present period of 'GIS education prosperity' [14] in three phases. The first covering the period between earlier seventies to mid eighties; later eighties, in second term; and last years, finally. In the specific case of GIS developments in geography, a precedent short abstract on the whole is available too [20].

As a epic phase, first one comprises several experiences without apparent relation. Initiatives in public administration had their common fact in the titanic endeavour in the deal of establishing hugue data bases [6,16,18,19] characterized by geographic referentiation. In general, the 'data base' term is more emphasized than 'geographic' one. Incidentally, the cited handbook [C] still claims for the 'data base' primacy in GIS. Experiences lastly concluded with the arrival of the new generation of hardware and software difussed in Spain up the mid eighties. In other hand, university initiatives focused research in the implementation of the landscape evaluation models [1,23] in the GIS raster methodology analysis. Supply in graduated or postgraduated education in GIS were absent in the university courses. Among other causes, the insufficient informatic equipment was a strong handicap.

During the second phase, perhaps as a classical period of consolidation, dissemination and increase in number of professional and research teams generalizes the knowledge of GIS. The fall of costs in informatic investment permits a great diffusion in the private and university milieu plus the retroconversion of public agencies. In the university level, teachers and students start temporary migration to leading centers in Europe and USA for training in GIS. Geographer JA Cebrián, a pionner in this transnational circulation

wrote yet in 1988 the first summary scheme for a GIS handbook in Spanish [8]. Later, he materialized interest in advanced conceptual GIS in a handbook, published in English [D] and a reflection on the communication components in GIS [9]. Other seminal vocations in this period will ended later in the first GIS Spanish doctoral dissertations [12,21]. At the same time, university departments of geography, engineering, informatics, etc., began to offer postgraduated courses in GIS. No Spanish handbook are still available at that time.

Nevertheless, applications in public land administration are a strong weight stimulus for the phenomenon of diffusion. In special, compilation of environmental studies for structural and local planning acted as a vigorous magnet for attracting many private planning bureaus to GIS world. Demand from agencies devoted to service networks creation and sustenance, reinforce that spread. In this context, the Spanish Real State Agency adoption of the GIS methodology implied a real 'coup de grâce' in 1989. Jordi Guimet, one of the defenders of that change in the real state plans compilation wrote the first handbook in GIS that may receive this title in Spain [F].

In the present decade, or 'prosperous' third phase, an exogenous fact incides positively on widespread of GIS and in its collective identification as a mater of study. The graduate curriculum renewal had permit introduction of explicitly training GIS in the University. Students in geography, environmental sciences, topography, etc., are introduced in the techniques of spatial analysis in the GIS context. Also, like a olympic euphoria a persistent reflection on GIS education was produced since 1992 with projected syllabus as a backdrop. It is time for reviewing the situation [12,11,13, 22]. In other way, it is time for proposals too [3,4,5,10]. Obviously, is just the moment for 'parution en scène' of the handbook materials to support education.

Revised handbooks

- [A] Bosque Sendra, Joaquín, 1992. *Sistemas de Información Geográfica*. Madrid: Ediciones Rialp, 451 pp.; 340 references.

General contents 1. Introduction: GIS definition; Geographical data; Geographical data on digital record; SIG's hardware and software; 2. Vectorial GIS; 3. GIS raster; 4. Digital Terrain Models (DTM).

- [B] Bosque, Joaquín; Escobar, Fco Javier; García, Ernesto; Salado, Ma Jesús, 1994. *Sistemas de Información Geográfica: prácticas con PC Arc/Info e Idrisi*. Madrid: RA-MA Editorial, 478 pp + subject index; 30 selected references.

General contents: 1. Main introduction: SIG definitions; relational data bases; SIG' software tipology; 2. PC Arc/Info exercises; 3. IDRISI exercises; 4. Data exportation between packages.

- [C] Calvo Melero, Miguel, 1993. *Sistemas de Información Geográfica Digitales: Sistemas Geomáticos*. Vitoria-Gasteiz: Instituto Vasco de Administración Pública, 616 pp.; 16 references.

General contents: 1. Fundamental concepts ans definitions; 2. Superstructures management; 3. GIS tipology; 4. Gatering, structuring and interchanging problematic; 5. GIS implementation

and evaluation.

- [D] Cebrián, Juan Antonio, 1994. GIS Concepts. Cáceres: Infocarto SA; Dpto de Geografía y Ordenación del Territorio UEX; Grupo de Métodos Cuantitativos (AGE), Fundicot Extremadura, 265 pp.; 160 references.

1. Introduction; 2. Mapping the earth's surface: Preliminary concepts and Geometric Data Models; 3. Information structuring principles: Graph theory and structures; Abstract data types and Semantic modeling; 4. Data models for GIS: the relational model and further data models; the geographic object type; 5. Indexing concepts and techniques: clusters of spatial information; indexing nonspatial files; indices for spatial databases; [6.] Conclusions

- [E] Comas, David; Ruiz, Ernest, 1993. Fundamentos de los sistemas de Información Geográfica. Barcelona: Editorial Ariel, 283 pp + subject index; 120 references;

General contents: 1. SIG's: applications; 2. The development of GIS; 3. GIS definitions and components; 4. The geographic information; 5. The Geographic Base Data creation; 6. The Geographic Information analysis; 7. The organization and training about GIS.

- [F] Guimet Pereña, Jordi, 1992. Introducción conceptual a los Sistemas de Información Geográfica (SIG). Madrid: Estudio Gráfico Madrid, 137 pp.; 8 references.

General contents: 1. Basic concepts; 2. Elements of cartography; 3. SIG's elements; 4. Cartographic and geographic information: gatering technology; 5. Data bases: design and renewal; 6. Spatial analysis functions; 7. Mapping and publishing technologies; 8. Applications: Real Estate, urban planning, environmental management, retail studies, services management, automatic cartography, transportation networks; 9. SIG project implementation proces.

- [G] Gutiérrez Puebla, Javier; Gould, Michael, 1994. SIG: Sistemas de Información Geográfica. Madrid: Editorial Síntesis, 251 pp.; 170 references.

General contents: 1. What are the Geographical Information Systems? 2. Geographical data nature; 3. Data structures and models; 4. SIG raster; 5. Vectorial SIG; 6. GIS history and future perspectives; 7. Applications: environmental studies, real estate, trasportation, basic systems networks, risk protection, retail studies, urban planning.

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- [2] Bernardo, I.; Calvo, M.; González, JM., 1992. La enseñanza de los Sistemas de Información Geográfica en las Escuelas de Ingeniería Técnica Topográfica. Actas del V Congreso Nacional de Topografía y Cartografía, Madrid: Colegio Oficial de Ingenieros Técnicos en Topografía, vol 5-6, pp 323:341
- [3] Bosque, J., 1992. La enseñanza de los Sistemas de Información Geográfica. Actas del V Coloquio de Geografía Cuantitativa. Zaragoza: Servicio de Publicaciones de la Universidad de Zaragoza, pp 47:57
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