

TEACHING OF CARTOGRAPHY IN THE CURRENT DEGREES IN GEOGRAPHY IN THE SPANISH HIGH EDUCATION

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Recently, there has been a huge renovation in methods for teaching Geography to adapt to the Knowledge Society's needs with rapid changes in the way that students apprehend the territory and landscape. Undoubtedly, the new technologies applied to the different expertise areas in Geography and Cartography have determined a new paradigm regarding the accessible volume of information.

It is accepted the most precise and economical way of studying the current environmental and socioeconomic problems is analysing and quantifying all of them through the study of landscapes and territory. Owing to this, it is remarkable to use in class all the resources, which let a global perspective approach, i.e., remote sensing images, ortho-photogrammetry, and digital mapping.

Maps are necessary in teaching Geography as well as the necessity that geographers contribute to their performs. Maps enclose the complexity of building bridges between reality and users. The map is effective whether it fulfil certain obliged qualities. At educational level, the student learning in Cartography requires a major detailing in the knowledge of skills and attitudes than that current use of maps which normally is done in class.

According to the Libro Blanco de Geografía, in 2005, 17% of geographers in Spain associated their professional work to Cartography implying generation of digital mapping database, representation and visualization of statistical data in map format, as well as specific thematic mapping. Taking into account this, we can ask our-self: do students learn adequately Cartography in the Spanish degree of Geography in order to generate

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excellent and useful maps? Do the subjects related to Cartography in those degrees cover the necessary contents to achieve the minimum skills to face the main tasks a geographer deals with in his/her career, especially, those related to the new geographical information technologies? Regarding these questions, this study faces the objective of describing the state-of-art related to the teaching of Cartography in the Spanish degrees of Geography as well as in other degrees with significant content of Geography (degrees in Geography and History, in History, and in Humanities).

In order to achieve this goal two source of information were used for the study:

-The Spanish Ministry of Science, Innovation and Universities. This governmental office offers a public database (QEDU) where all the high level education related to the teaching in Geography is compiled (among others): degree in Geography and Land Management, degree in Geography and History, degree in Geography and Environment, and degree in Humanities.

-Webs from universities where those degrees are offered. All the student guidelines related to any subject of Cartography were downloaded from them when possible.

Considering both source of information, a database of subjects related to Cartography was performed recording the following data: subject name, character (core, compulsory, optional), course, ECTS, duration, contents, teaching methods, qualification system, and references.

According to the database, most of the analysed degrees included at least one subject related to Cartography, especially, those degrees in Geography. From 23-selected degrees, three of them were degrees in Geography and History in which one subject was toughed at least. In total, 34-subjects in Cartography were counted and included in the database. The number of subjects per degree was variable: one-subject, 59.1%, two-subjects, 36.4%, more than two, 4.5%. The ECTS was of 6 in all cases unless in one case (12-ECTS). In general, the subjects of Cartography were included in the first course (65.7%) followed by the fourth (14.3%), third (11.4%) and second ones (8.6%). The subjects included in the first course was mainly either core or compulsory in character, while optional those in the third and fourth courses. Similar to the ECTS, unless one case which was an annual subject, the subjects were imparted in only one semester in all cases.

Also, the student's guidelines were analysed. In this analysis, it was differentiated whether there were either one or two subjects of Cartography in the degree because this included contents about fundamental and thematic Cartography when it was only one. The subjects with either core or compulsory character were found in all the consulted degrees. These usually had the objective of introducing students in the Cartography, its role in the society and in the geographer professional tasks. Besides, there were other objectives related to the thematic contents of each subjects.

The fundamental Cartography was structured following these main topics:

1) Introduction to Cartography. It was a basic topic introducing the students in this matter because it is usual to be the first time facing this one for all of them. This unit was found in all the student's guidelines.

2) History of Cartography. Sometimes as an independent unit or included in the previous one, this was not always found in the student's guidelines. Its objective was to show a general overview of the historical evolution of Cartography emphasizing the role played by the maps in the different societies and their relations to Geography.

3) Fundamentals of Cartography. This general term covered basic but very important topics in the mapping learning: shape of the Earth; how to pass from a curve surface to a plane; projection and coordinate systems; the scale and measurements; typology of maps and cartographic sources; characteristics and elements of maps as well as their interpretations, designs, and uses.

4) Basic mapping. This kind of subject focussed on improving student skills about management and interpretation of geographical data from topography maps. Some main issues are of interest: comprehension and interpretation of topography using contour levels, and interpretation of physical and human features in the landscape.

5) Thematic mapping. Most of the student's guidelines of this subject included one unit related to thematic mapping. It was emphasized the types of maps performed using points, lines and polygons, as well as the variable representation with symbols, isolines, etc.

6) Mapping and Geographical Information Technologies. These were units with contents about recent advances in Cartography, from the printed to digital maps as well as from Geographical Information Systems (GIS) to Web Services, INSPIRE European Directive, among others. In some occasions, it was done an introduction to the use of GIS, LTS-LIDAR technology, and aerial and terrestrial automatized photogrammetry (SfM-MVS).

6) Finally, it could be possible to find other topics in few guidelines as well. For instance, it was remarkable those related to semiology, and legislation affecting mapping production in land, urban, and environmental management.

Apart from this fundamental subject of Cartography, in some degrees, another specific subject in thematic mapping was also considered. This kind of subject was mainly structure with the following contents:

1) Mapping language, semiology, visual variables, labelling system, representation criteria, as well as the techniques needed to perform correct and legible maps.

2) Learning of thematic mapping and types of maps, as well as those required for field work and GIS.

3) Elaborating mapping projects, managing spatial infrastructure databases, and producing mapping products in virtual and interactive reality.

4) And different mapping topics related to Physical and Human Geography and Land Management.

In general, students in the degree of Geography from Spanish universities receive a very basic learning in Cartography attending theoretical, technical and applied knowledge in order to develop the main skills in this subject: in summary, being able to acquire geographic information to synthesize with the goal of its mapping with a minimum technical and semiologic quality, obtaining correct mapping products to be used in research, teaching, and land management and planning.

However, according to the consulted subjects, there was a weakness in their contents: new recent advances in Cartography usually are missing with the exception of very few cases. Thus, it was very limited the knowledge acquired by students regarding the new technologies as LIDAR, UAV, and programming (since in most of cases GIS are already implemented as learning tools in this kind of subject).

The learning was uncompleted in these new topics, which by the way is every time more demanded in certain researches and companies for geographers. Nevertheless, we would say it would not be recommended to introduce these new topics in a basic cartography subject since it is usual to be the first time this matter is faced by the students of degrees in Geography. However, it would be useful to include new subjects regarding those topics focused to acquire skills in them whether the degrees were reformed in short to medium-term.

In summary, after reviewing 43-guidelines related to Cartography subjects from 23-degrees in Geography, but also some from others in Geography and History, and Humanities, we can conclude:

1) There was at least one basic subject in Cartography in the analysed degrees. In general, they covered one semester, in the first course, with 6-ECTS. When the subject was thematic mapping, this did not appear in all the degrees in Geography, so their students received less formation in Cartography, what is a key issue for their professional, teaching, and research future.

2) The contents of basic subjects in Cartography covered a wide vision of mapping products and documents, its history, basis in technical and artistic matter, and learning in interpreting topographic maps and other thematic ones. When a thematic mapping subject was included in the degree, these ones focused on semiology and manners of representation for a correct mapping.

3) Finally, there was no a homogeneous situation regarding the study of Cartography in the degrees of Geography in Spanish universities, what may have negative effects

in the geographer's skills from a professional, teaching, and researching point of view, depending on the university selected by the student for his high-level education as Geographer. We recommend to widening the studies in Cartography, especially, to include the new technologies.

