PROTOTYPE OF A GIS APPLICATION FOR TEACHING THE GEOGRAPHY MATTER AT SCHOOL IN COLOMBIA

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INTRODUCTION

In Colombia there are several good examples of Geographic Information Systems (GIS) applications that are full working. Nevertheless in the field of education, GIS have not yet introduced in our country, particularly, in the basic secondary education level, that represent six to nine grade of secondary school. Nowadays, at schools, teaching is doing at the conventional way, and the use of computers is very poor particularly at public schools.

In some private schools the students have more access to technical resources like computers and internet. However teachers of secondary, in most of the cases, do not use computers for their work. For these reason the Distrital University, as a superior academic institution of Bogotá, join its efforts with the Association of specialist in GIS and Remote Sensing of Colombia (SELPER) in order to create a GIS application project, which support the teaching using GIS at schools.

The purpose of this paper is to show the developments of the project and the impact in the use of the GIS technology for teaching geography at the classroom in Colombia.

The aim of the project is to develop a prototype of a GIS application for teaching the geography matter at schools, using the academic standards of the basic secondary education in Colombia, taking into account, that geography is a very important aspect of the territory and an essential element of the GIS.

The second objective is to familiarize the secondary teachers with the use of GIS technology as a tool that support their work at the classroom.

GEOGRAPHY EDUCATION IN COLOMBIA

Geography matter in Colombia it is not teaching as a single matter, is teaching in a Social studies lecture, and involved many themes for the different levels at the secondary school.

Actually the social studies education is focused or based on competences. Each competence requires knowledge, abilities and capabilities in order to get the respective skills. The main characteristics of the curriculum considered in this project are the following:
1. The education process is centered to the student in order to make him able to be an integrated person as a community member
2. The education programs must be to maintain the balance between the theory and the practice application of the knowledge
3. The curriculum must be a dynamic system for the personal formation and social integration of the student
4. The education process must involve the study of the national and international problems and relevant events

In the nowadays context in Colombia, Geography includes the spatial and environmental relationships and the economy in order to understand different ways of human organizations and their relationship with the natural landscape. The Colombian standards regarding the geography subject are as follows:

VI to VII grade	VIII to IX grade
- The student is able to understand the earth characteristics as a alive planet - The student is able to use coordinates, legends scales in order to work with maps - The student recognize and use the time zones - The student is able to understand the geographic space and the different physical aspects of the environment - The student can establishing relationships between the geo-spatial location and the climate characteristics of the different cultures - The student can identify the production systems of different cultures and different time periods and make relationships between all of them - The student is able to understand the different economic organizations in Colombia and make analysis and explanations between their differences and similarities	- The student is able to describe the principal physical characteristics of the different ecosystems - The student can explain the impact of the environment in the type of social and economic organization in the different Colombian regions - The student can compare the ways of relationships between different cultures and communities in Colombia - The student can compare the causes of the migration and human recruitment in the territory in the XIX century - The student can explain the impact of migration in the politic, social, economic and cultural life in the XIX century

- The student is able to describe the characteristics of the natural regions of Colombia - The student is able to identify the economics, socials, politics and geographic factors that have been generated the different recruitment process	- The student can identify the modernization process in Colombia in the XIX and XX century

Table 1: Colombian standards regarding the Geography Subject

GEOGRAPHY CONTENTS AT THE SECONDARY BASIC EDUCATION IN COLOMBIA

The program contents integrates the subjects of geography and history and, at the same time, try to introduce these two subjects between the Latin-American and worldwide framework.

VI Grade

In this grade it is including the basic concepts regarding to: evolution, adaptation, culture, civilization, transformation, changes and differences if they were produced by natural effects or by human renovation of the landscape.

VII Grade

The social studies in the VII grade, is focused on the following topics: space, time, socio-cultural structure with emphasis on three elements: economic relationships, politic relationships and knowledge and collectives expressions.

VIII Grade

The social studies program on the VIII grade comprises the social economic changes in Europe, the industrial revolution, and the romantic age. Also the program includes the imperialism, the colonial expansion and the causes of the First World War. The Colombian geographic structure, their economical organization and cultural life on the XIX century are teaching in this grade as well.

IX Grade

In this grade the program is designed in order to the students gain an integral knowledge about the XX century society trough the relevant events, like the liberal republic, the Second World War and the beginning of new ideologies.

METHODOLOGY

The methodology used is based on the following activities: a) search and analysis of the existing information such as: digital maps, aerial photographs, documents, books concerning geography, etc. b) Analysis of the contents of the geography syllabus that are going to include in the application. c) Design and creation of the GIS application. d) Testing and adjusting the application. e) Dissemination of the results

The application is developed using commercial software and incorporates the topics regarding the Colombian standards for teaching geography as follows:
- Understanding earth
- Understanding grids and coordinates
- Using maps to find geographic information
- Understanding economic geography
- Understanding our nation Colombia, (relief, natural regions, natural resources,

THE GIS PROTOTYPE

The prototype of a GIS application for teaching the geography matter at school in Colombia handles physical and socio-economic information of the country and simulates different scenarios.

Physical Geography

Hydrography: In this layer are considered the water bodies, drainages and the main rivers and pounds of Colombia. Also presents a reflection about the use and care of the hydrological resources on the world. The competences in this topic as the following:
- Description of the earth characteristics as an alive planet
- Description of the main physical characteristics of the different ecosystems

Relief: Colombia has different types of landscapes like valleys, mountain ranges and plateau with a wide variety of vegetation and rivers. Therefore the prototype includes the following themes: Easter mountain range, Western Mountain and central mountain range, the principal valleys and the Serranías The competences in this topic as the following:
- recognize the relief characteristics of the earth
- Localization of the main cultures in the geographic space and recognition of the main physical elements of the environment

Economic Geography

Natural regions: Geography discipline is very important in the planning field, because it gives a support, knowledge and basic tools for improving the life level of the people according with their environment. The prototype contains the following topics: Andean

Region, Caribbean Region, Orinoquia, Amazonia and Pacific Region. From the economic point of view the regions incorporate the amount of agriculture production, the land tenancy and unemployment in the country. The competences are the following:
- Description of the characteristics of the different Colombian natural regions
- Explanation of the influence of the environment in the type of social and economic organization

Territorial Division: Describe the concept of the territory and its boundaries in the geographical space. The competences are the following:
- Identify the elements for establishing the political division of the territory
- Comparison and explanation of the political division changes in Colombia

Population: Geography matter studies the human being and their relationship with the geographical space in order to establishing the physical and human causes and consequences of the behavior of the population in their location. In this topic the prototype includes: demographic statistics, total of inhabitants, sex and age and the density of population as well.

Culture and Etnia: In this topic the prototype presents the historical evolution of the Colombian population, their characteristics and the different Colombian culture groups as: antioqueño, caucano, cundiboyacense, costeño, isleño, nariñense, llanero, santandereano y tolimense.

REQUIREMENTS OF THE GIS APPLICATION

The requirements of the GIS application were divided in two stages. The First one is to determine the functional requirements and the second one is the determination of the not functional requirements.

Functional Requirements

The Functional requirements help to identify and define the elements that compose the architecture of the system. The application is developed in ArcGis Server and has the capacity to provide a user interface in order to visualize and make queries to the Spatial Data Base. The main elements build in the GIS application as the follows:
1. User interactive interface
2. Visualization of spatial information in a qualitative or quantitative form
3. Activation of layers
4. Navigation inside the application to search and to visualize spatial data

Not functional requirements

They are requirements that specify the elements for the performance of the system. Some of these requirements are the following:

1. Consistency of the application
2. Usability of the application
3. Efficiency of the application
4. User participation
5. Documentation
6. Hardware considerations

GIS APPLICATION CONTAINS

The geographical Colombian data was created in ArcGis. The obtained layers are the following:

Name	Theme	Type	Definition
aepoint	Aeronautical	Point	Aeropuertos
cline	Cultural Landmarks	Line	Sitios Culturales
clpoint	Cultural Landmarks	Point	Sitios Culturales
dnnet	Drainage	Network	Drenajes
dnpoint	Drainage	Point	Drenajes
dspoint	Drainage Supplemental	Point	Drenaje suplementario
hsline	Hypsography Supplemental	Line	Hipsografia Sumplementario
hspoint	Hypsography Supplemental	Point	Hipsografia Sumplementario
hynet	Hypsography	Network	Hipsografía
hypoint	Hypsography	Point	Hipsografía
lcpoint	Land Cover	Point	Coberturas
lcpoly	Land Cover	Polygon	Coberturas
ofline	Ocean Features	Line	Características Océanos
ofpoint	Ocean Features	Point	Características Océanos
ponet	Political/Ocean	Network	Limites políticos de océanos
popoint	Political/Ocean	Point	Limites políticos de océanos
pppoint	Populated Places	Point	Lugares populares
pppoly	Populated Places	Polygon	Lugares populares
rdline	Roads	Line	Carreteras
rrline	Railroads	Line	Ferrocarril
tsline	Transportation Structure	Line	Estructura de transporte
utline	Utilies	Line	Utilidades

MAP PRODUCTION

The maps to publishing in the GIS application were defined as dynamic and static maps. Some of them are the following:

- Departmental maps: Provides the information about the territorial division of Colombia called Departmentos, in total are 32 departamentos.
- Municipal Maps: Gives the information regarding the territorial division in Colombia called Municipio
- Hydrography Map: Gives the information about the main rivers and pounds of Colombia
- Relief Map: Provides the information regarding the Colombian relief with emphasis in the mountain ranges
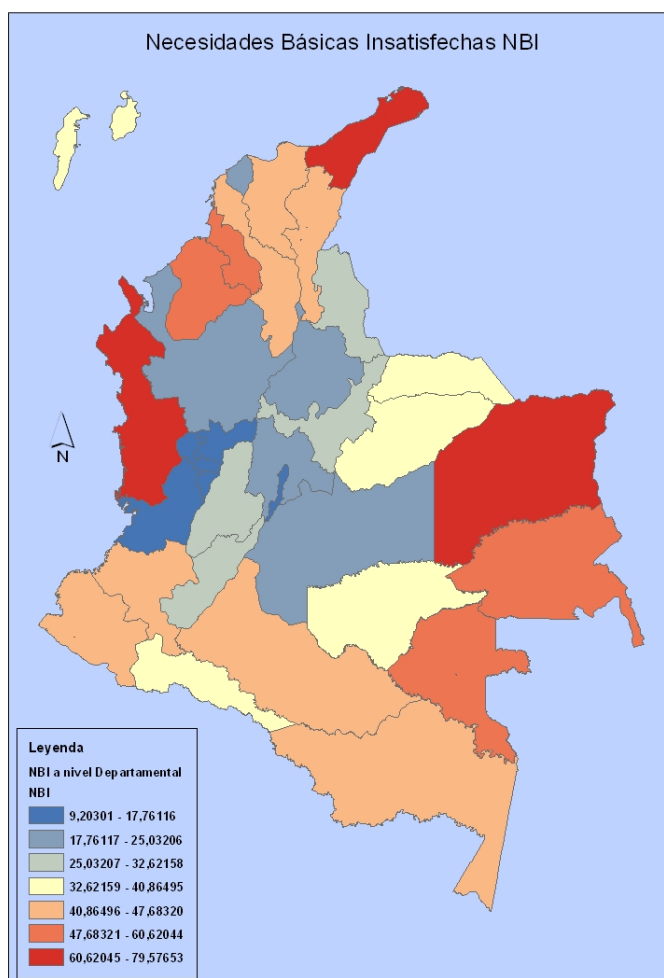- NBI Map: Gives the information about the basic supplies of the population

Figure 1: Example of the NBI map

- Population Map: Makes available the information regarding the population of Colombia at department and municipality level

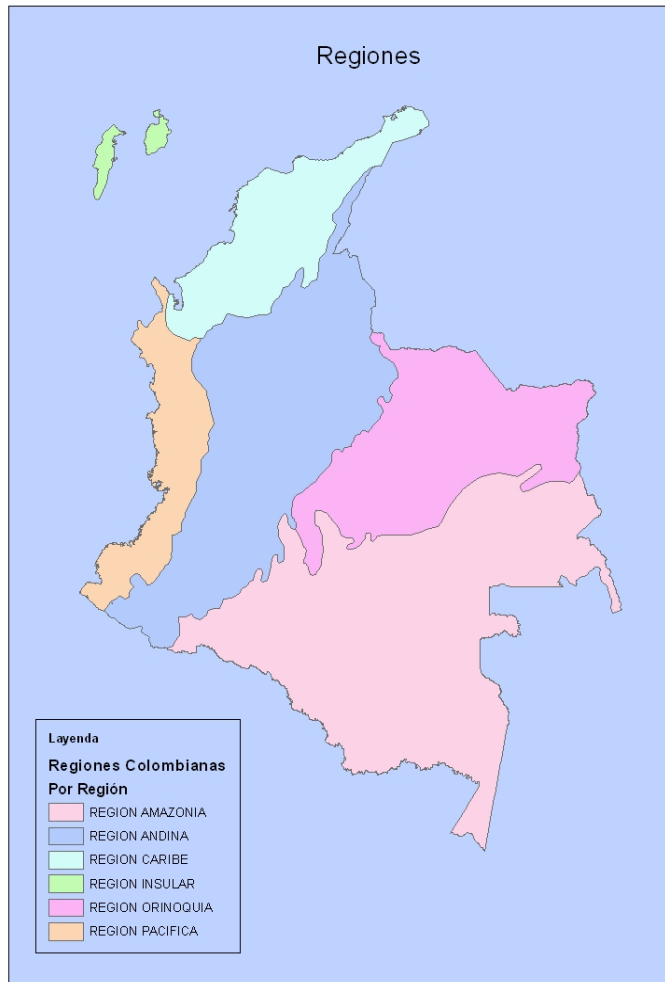- Natural regions Map: presents the information about the different regions in the country

Figure 2: Example of the Natural Regions map

- Etnias Map: Shows the information about the etnias and culture groups of Colombia

The GIS application uses static and dynamic maps for visualization of spatial data and includes concepts and theory about geography and cartography as well.

RESULTS

The principal result of the project is the GIS application that will be use by teachers at school. Before, to implementing the application, it is important to design and put into

practice a good training course for teachers in order to get better results and to motivate them in focused about how to teach geography using GIS technology.

CONCLUSIONS

This project is really important because it is the one of the first initiative in Colombia and will be implementing not only on public schools, but also on private schools using internet. The project also involved an important group of professionals such as geographers, teachers of social studies with emphasis in geography, computers systems engineers, GIS specialists and students of a Cadastral and Geodesy program.

In the second stage is planned to adjusting the GIS application for any other subjects such as history or biology to increase the use of GIS for teachers at secondary schools.

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