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Geographical Information Systems (GIS) - from Daily use to Professional Training and Master Courses

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Geographical Information Systems (GIS)-from Daily Use to Professional Training and Master Courses

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GIS competence is increasing and GIS applications are nowadays used in nearly every area of society. In the perspectives of lifelong learning the needs for GIS knowledge vary widely among target groups depending on previous knowledge, interests, profession, language, age, ability, economic resources and employability. GIS allows us to view, understand, interpret, request, and visualize data in many ways that reveal relationships, patterns and trends in the form of maps, globes, charts and reports. Geography plays a role in nearly every decision we make. For the future there are many issues such as: How can GIS competence development be accomplished at reasonable cost? How can groups with GIS competence needs be targeted, with flexibility in time and space? How can GIS courses be adapted to people who are employed or, for some reason, require high levels of flexibility in time, location and study pace? How can children and new groups be persuaded to become interested in GIS? These challenges have been addressed by the eGIS+ project (2007 – 2009), which is a pilot project within the Leonardo da Vinci Program (LdV). The eGIS+ partnership develops, disseminates and valorizes results from the former E-GIS project (2002 – 2006). E-GIS was most successful, and experience has suggested new possibilities and needs for satisfying even a broader range of interested user groups. eGIS+ aims to develop new applications and practical approaches for accomplishing information and competence development. www.e-gis.org is a web portal for GIS resources developed through eGIS+. Expected results will be to generate a better awareness of GIS applications and usability, and to spread GIS knowledge to wider audiences.

INTRODUCTION

GIS - Geographical Information Systems, are systems for retrieving attribute data from digital maps. Attribute data may be information on natural resources, environmental problems, pollution, transport logistics, the spreading of diseases, physical planning and much more. Such attribute data are linked to digital mapping through GIS databases. More advanced GIS include geographical data modelling and analysis, describing how features located close to each other interact and have influence on each other [1, 2, 3].

Data retrieval is either by identifying objects on the map and extracting corresponding attribute data, or by selecting specific attributes (e.g. properties belonging to a specific user) and visualising where the corresponding map objects are situated using digital mapping [4, 5]. During recent years, digital geographical databases have become available using the Internet as well as on small "mobile electronic boxes" (e.g. mobile phones, PDAs). The growing use of the Internet together with commonly available Global Navigation Satellite Systems (GNSS) [6] has brought GIS technology to an increasing number of end users.

The eGIS+ project is a part of the Lifelong Learning Programme (LLP) and builds on the experiences from the previous E-GIS project [4, 5] implemented under the Leonardo da Vinci Programme (LdV) (www.e-gis.org). E-GIS developed a one year on-line study program (Table 1) with eight course modules, covering a variety of topics including basic GIS theory, GIS applications such as environmental- and resource planning, Internet GIS, GIS databases and GIS in Organisations. The courses were aimed at user groups in higher education, and over four hundred students were enrolled from all parts of the World. The course outlines were flexible allowing individual students to choose their own study pace (open start and end), study mode (online, CD ROM) and material format (text, video, audio and interactive tools).

SOME INTERESTING FIGURES FROM THE E-GIS PROJECT

On analysing the student statistics from the E-GIS courses [4] we found that social and gender data showed that: the age of students ranged from 20 to 60 years, with an average of 31 years; 70% of the students were men and 30% women; students came mainly from engineering and science backgrounds; 60% were single; 30% lived in families with children and 10% were married without children; 65% stated that they could find a comfortable study environment at home; 21% were not employed while studying, while 62% were employed full-time, 6% worked halftime and 9% worked part-time; 10% of students received financial support for their studies from their employer.

Concerning data related to computer and Internet experience and practice the material showed that: 4% stated that they did not have easy access to a computer with internet connection while 53% had it at home, 52% at work and 24% found it elsewhere, 95% felt confident as computer and Internet users but 13% felt that computers made studying harder; see Table 2.

CHALLENGES

The partnership in the E-GIS project was spread all over Europe and there were therefore differences in approach to a number of issues around education, such as in technical skills and traditions, copyright problems on learning materials, Internet facilities, study credit and grading systems, the financial situation for staff and students, problems regarding examinations, how to merge/reuse learning materials from different institutions in a new course, streamlining, high drop-out rates, language skills, pedagogic approaches and students enrolled.

Course		Content
GIS 1	10 ECTS	A general introduction to GIS. Knowledge about spatial (map) and attribute (e.g. tabular) data.
GIS 2	10 ECTS	Continuing course based on GIS 1. Teaching students how to collect data and handle data bases. Data analysis for solving spatially related issues.
Specification of GIS in Organisations	7,5 ECTS	Identification of user organisations' needs for geographical information, fitting these needs into the current framework (internal and external) and formulate the needs in a specification.
GIS in Physical Planning	10 ECTS	GIS used for physical planning of e.g. individual houses, roads, villages and towns.
GIS in Resource Planning	7,5 ECTS	An introduction to GIS as a planning tool for resource management.
GIS in Environmental Planning	7,5 ECTS	GIS methods in handling environmental data and processes in a GIS environment.
Geographical Data Modelling and Management	7,5 ECTS	Using conceptual schema languages to describe (simple) information models.
Internet GIS	7,5 ECTS	How to visualise geographical data, both as traditional maps and as perspective views and to distribute and use geographical data over Internet.

TABLE 1
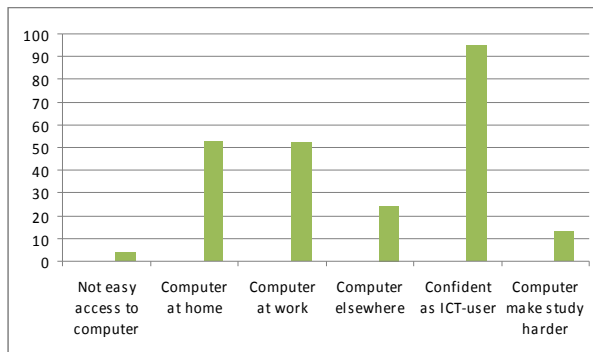DEVELOPED E-GIS COURSE MODULES LEVEL AND CONTENT

TABLE 2
OVERVIEW OF COMPUTER AND INTERNET ACCESS

eGIS+

All former partners agreed to jointly submit a proposal for a new project under the Leonardo Lifelong Learning Program (LLP), Transfer of Innovation (ToI) based on the experiences, challenges and successes of the former E-GIS project. The project proposal was accepted and eGIS+ was born.

The main idea of this project is to adjust and further develop courses in order to fit them for a broader range of user organisations and user groups within the EU. This will be achieved by identification and analysis of demands and choices, adjustment and development of appropriate material e.g. by translating parts of courses into partner languages, and the use of new technical tools and pedagogy [7, 8] such as Web2.0, Social Web [9, 10, 11] and Open Educational Resources (OER) [12]. The project aims are to try out new digital technologies and to create more flexible pedagogical models [13] for adaptation to different types of target groups. The modules in E-GIS were all aimed at user groups at higher education level and, though successful results were achieved from these groups, evaluation demonstrated needs for GIS competence and updating at lower and non-academic levels [4]. There is an obvious need for shorter courses among people, private and civil service employees that can fill small competence gaps among different user groups [14]. The concept "micro-training" has been introduced meeting such competence training demands [15]. The main objectives are to develop a range of learning materials, with a range of flexibility, from two minute "tasters", to two hour and two day courses, (Micro-training) [15] and further two ECTS courses, Open Educational Resources (OER) [12] and a full Masters Program.

AIMS, OBJECTIVES AND TARGET GROUPS IN eGIS+

The main objectives of eGIS+ are:
1. To develop information materials and courses which are accessible at low or no cost to the student. These include use of open source solutions, both for development and management of courses (Learning Management Systems, LMS, such as e.g. Moodle) and for GIS work to improve accessibility and flexibility for people, organisations and countries with lesser means of funding for GIS implementation and use.
2. To include the European INSPIRE initiative [16] concepts and use of Spatial Data Infrastructure (SDI) [17] in the courses developed during the past E-GIS project. This includes knowledge transfer concerning new joint European standards for spatial data storing and sharing, as well as how to access these data.
3. To break down the existing courses into smaller components suitable for training situations outside traditional academic spheres developing small general courses as well as more specialized ones, depending on target group. Focus will be on three main target groups: employees (for work based learning, just in place and time to facilitate flexibility), university students and staff and secondary school teachers.
4. To increase recruitment by developing new pedagogic concepts targeting sub-groups e.g. disabled persons WCAG2.0 [18] refugee minority groups and prisoners.

5. To investigate and develop technological solutions and social computing, such as web2.0 [9, 10, 11].
6. To reduce language related problems by translating courses and parts of courses to languages of the partner countries, and maybe later to a number of other European and non-European languages (e.g. minority languages in Europe)

The impact envisaged is that people, universities, private and civil service organisations involved will start using technology and methods developed in the project and see the benefits of GIS as a genuine tool for organising spatial data, and increasing the interest from e.g. school teachers and secondary school students. Typical learning outcomes for people will be higher qualifications suited for specific careers, better understanding of GIS at different levels, and training in using Internet as a learning platform and knowledge and experience in international cooperation.

PARTNERS IN eGIS+

The partnership comprises the university partners from the previous E-GIS project, one new university partner and three new stakeholders within GIS. The Following institutions are working, aiming at the goals of eGIS+: Gjøvik University College NO (contracting and coordinating institution), Lund University SE, Bulgarian Academy of Sciences/Solar Terrestrial Influences Laboratory BU, University of Patras GR, Vilniaus Gedimino Technikos Universitetas LT, Institute for Geo-Information Science and Earth Observation NL, Statens Kartverk NO, Centrum Informacji o Środowisku UNEP/GRID-Warszawa PO, Instituto Superior Técnico/Universidade Técnica de Lisboa PT, Lantmäteriet SE.

ACTIVITIES IN eGIS+

The courses from the E-GIS project [4], described above (Table 1) will serve as a base and students will be able to study single courses or a complete one-year program. The aim of eGIS+ is to provide shorter courses (more on demand) for different target groups, but probably also with some changes of content, depending on the specific target group.

In eGIS+, a web-portal is designed and developed, with a pilot already in place, www.e-gis-org (Figure 1). The idea with the portal is to inspire and disseminate information about GIS and the implemented courses. The portal is designed as clouds, in areas such as What is GIS?, Games, Do it yourself, Jobs, Find data, Education and Test your GIS knowledge. In the portal, the variety is manifold and information is available about nearly everything from short modules varying from, on the first level, a few minutes up to a couple of hours and two days [15] are developed with presentations such as video clips, audio, pictures, text with local GIS examples in partner countries adapted to different target groups and on different levels. The modules will be translated to a number of languages, with open access for anybody. The modules can be used as micro-training [15] and Open Educational resources (OER) [12]. All materials are free to use for everyone interested and all necessary GIS software is free for use by end-users. Second level is the two weeks courses [12], 3 ECTS short courses (three different courses); a) introduction to GIS, b) special subject e.g. archaeology and c) covering the implications of SDI on contemporary GIS activities in EU. Third level is revised GIS modules from the previous E-GIS (10 ECTS courses) (Table 2).

eGIS+ is a typical information distribution project and the web portal is one of the most important tools in the dissemination and validation process.

Course		Content
Web portal	Dissemination	A web portal, where all eGIS+ material can be available. The aim was to implement technological and pedagogic models and test selected LMS platforms for disseminating and spreading information about GIS to broader target groups.
GIS Information and application examples	Max 2 minutes tasters	Information and application examples presented in several languages, taken from different parts of Europe and the world, creating interest and enthusiasm about GIS and to encourage people to learn more.
GIS Information and application examples	Max. 2 hours tasters	Audio/video examples based on the product from the first phase of the project (E-GIS). The information and application examples will be presented in several languages
GIS information and application examples and short GIS course modules	Max 2 days tasters / OER	GIS courses, based on the existing E-GIS material. Lectures and exercises will be condensed in order to fit a broader range of user groups, including exposed groups and minority groups. The courses are free of charge.
Short course development	2 weeks 3 ECTS OER	Three courses covering different GIS aspects: One introductory course One dealing with GIS applications One covering the implications of Spatial Data Information (SDI) on contemporary GIS activities in the EU
GIS study	10 ECTS	Adapting existing E-GIS courses [4, 5] to open source LMS and GIS software platforms and to modernize the contents to reflect recent GIS developments in the EU.

TABLE 3
DEVELOPED E-GIS+ COURSE MODULES LEVEL AND CONTENT

FIGURE 1
THE EGIS+ WEB PORTAL

CHALLENGES IN EGIS+

There are a number of challenges ahead, for example developing and designing proper courses to be available "on demand", and to design small modules so that they can be combined to form a full program. Reaching new target groups with tailor-made concepts for different levels of flexibility is itself a challenge. The use of open sources, multimedia tools, and new interactive learning activities using the social computing (web 2.0) [9, 10, 11] will attract new groups (many games, for example, are already available on the internet and well used, although without knowing the underlying GIS-concepts). The portal will be important for Lifelong Learning and the 3rd mission initiatives, where new target groups can be reached possibly even generating interest in Higher Education. The objectives for the project are to create GIS interest among the public for use in organisations and hopefully among teachers and pupils.

SOME PRELIMINARY RESULTS IN EGIS+

One of the goals of eGIG+ is to spread GIS knowledge to broader audiences so as to promote awareness of GIS to a higher extent. So far, after slightly more than one year of the project, some interesting issues have already been developed, piloted and settled. The portal (Figure 1) can be navigated for different target groups, such as Primary Schools, Secondary Schools and Higher Education Institutions and then further for different issues of GIS. Another way of navigation is through interest, such as games and video, your places, historical places, what is GIS, GIS studies, GIS at work, GIS and the job market. Through the portal a user can also find out more about GIS for different target groups and for different levels as well. Samples have already been created. Most of the examples are expressed and developed through open sources and social computing, Web 2.0 [9, 10, 11] such as Wikis, YouTube and other sources which, already, are available on the Internet and where users can interact with the media and other users. The importance is that it is available for everyone for reuse of what "is already there". In order to create interest, initial knowledge and understanding of GIS, different target groups of all ages may find sources (games and tests) as given in the examples on the portal. Below follow some samples for different areas.

In the cloud for Games for testing geographical knowledge, mainly targeted at *Primary School level*, users will find some two-minute GIS samples, such as:

Travelling in Europe/ Find Capitals in Europe
http://www.e-gis.org/mod/resource/view.php?id=331

Famous maps
http://www.famousmaps.com/

Flags of the world
http://www.e-gis.org/mod/resource/view.php?id=333

Mapzone
http://mapzone.ordnancesurvey.co.uk/mapzone/index.html

Where are the football arenas? (An example of this you can see in Figure 2)
http://www.e-gis.org/mod/resource/view.php?id=340

- Football Arenas around the World
- English Premier league
- Swedish…
- Bulgarian…
- Portuguese...
- Etc.

FIGURE 2

A SAMPLE OF PREMIER LEAGUE VENUES FOR PRIMARY SCHOOL

In the cloud What is GIS?, mainly for *Secondary Schools* (more advanced – and more related to course material) users can find short explanations on "what is GIS?". For example, a short two-minute video from Lund University, SE, explains GIS in a very simple and basic way, but is also an appetizer with some illustrative drawings (Figure 3); see: http://www.e-gis.org/file.php/36/LU/PP_WhatIsGIS/pp4.html.

Another interesting type of "learning material" is "Sea level rising" on YouTube. In this example, there is an illustration on how land becomes flooded in different parts of the World as sea level rises; see: http://www.youtube.com/watch?v=TRa_yq8238g&eurl=

Another example on introducing GIS, is made by University of Patras, illustrating the travels of Alexander the Great:
http://www.e-gis.org/file.php/36/UoP/UoP_Greece/gis2_files/Default.htm

In the cloud for Education you can find information on *Higher Education* level short courses and courses giving 3 to 10 ECTS credits. There is also information on where you can study a full Masters Program as well as resources concerning the job market for GIS (Figure 4).
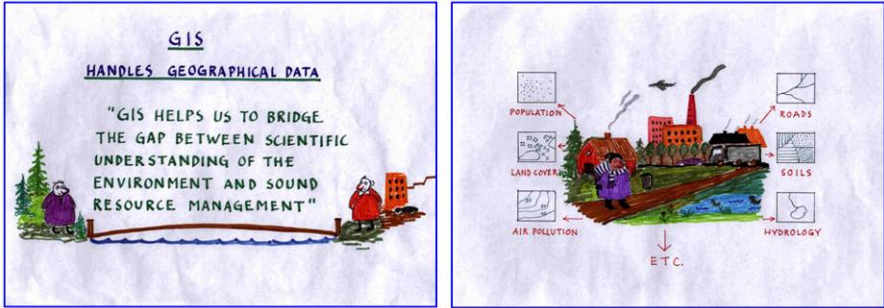

FIGURE 3

TWO OF THE DRAWINGS FROM THE INTRODUCTION VIDEO BY LUND UNIVERSITY, SE
HTTP://WWW.E-GIS.ORG/FILE.PHP/36/LU/PP_WHATISGIS/PP4.HTML
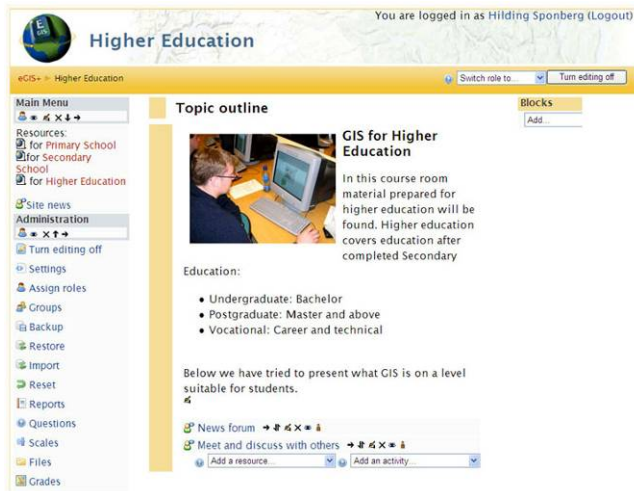
FIGURE 4

OUTLINE OF THE HIGHER EDUCATION PORTAL

Through the portal users also find information on how to study GIS at different levels, from very short and brief courses up to Masters courses at an international level. Below is an illustration of content for one of the courses for Higher Education (Figure 5). There are a large number of web-pages which can be accessed for different issues and matter of interests. Below are examples of interesting sites: http://www.geodata.com Information about underground construction and mining, surface and structures, industry and geo-instruments and software:

http://www.geonorge.no – Regional information and statistics about population and culture, agriculture, nature and environment, geology and many other topics (Norway).

http://www.geographynetwork.com (ESRI [1] – GIS and mapping software) – Share geographic data through a global network of publishers

http://www.maps.google.com – Find your route of travel, zoom up to detailed street maps etc.

http://www.maps.live.com – Search to find businesses, people, collections or places, get directions and check traffic etc.

http://www.maptech.com – A company that provides navigating in surveying, forestry, search and rescue, wildland fire fighting, hunting etc.

http://www.e-gis.org/mod/resource/view.php?id=362 – Part of the E-GIS homepage with links for visiting different European countries.
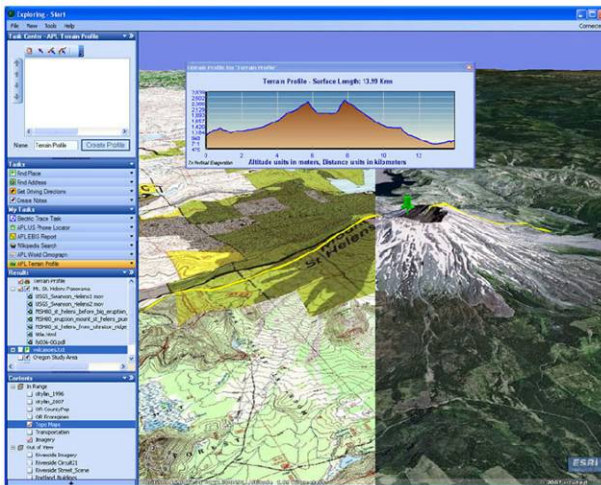

FIGURE 5
AN EXAMPLE FROM ONE COURSE IN HIGHER EDUCATION; SEE THE WORLD IN 3D

Games and self tests on different levels, with different content have also been developed and in the portal there will be several examples. These samples may be instructive and of great interest for any individual and target group who wants to achieve an understanding of "GIS".

GIS and geographical data are becoming more and more important for the whole of society, and for everyday use. A lot of applications on the Internet use this kind of techniques but few understand that there are GIS applications behind them. Google Earth

for example has become a success. The YouTube video about the possibilities Google Earth gives is one sample – http://www.egis.org/mod/resource/view.php?id=347

You can also find information about the job market, such as the video from YouTube about Geographic Information Specialists Job Description –

http://www.e-gis.org/mod/resource/view.php?id=352

EVALUATION AND VALORISATION

The project strategy is to make the portal known to as many potential users and user communities as possible. Advertising uses the networks which already exist between the partners, institutions and organisations inside as well as outside the European Union.

With the geographical and sectorial distribution of the partners in different languages and cultures, it is obvious that the project will succeed in disseminating information widely reaching large number of stakeholders.

The ideas and content of the project is to use open sources with more or less the same content, but at different levels for different target groups where individuals can choose contents and levels depending on interest and previous understanding. Being able to navigate around in the common Web portal has raised huge interest so far, as a new concept, among both professional GIS users and for beginners and for the general public.

SUSTAINABILITY

It is anticipated that further developments of the eGIS+ material will be attractive for universities and higher education institutions as well as in the open market among private, civil service organisations and the public in general. For universities there are challenges ahead for implementing Lifelong learning activities applying those new issues with Micro-training [15], and OER [12], combined with the ECTS courses, hopefully even for new target groups.

Many people nowadays unconsciously use GIS applications in daily life. eGIS+ will create awareness about GIS applications and usability.

CONCLUSIONS

The project has been disseminated in various European contexts so far and has been appreciated for its new concepts, comprising a broader range of target groups and the use of GIS material with the same content but on different levels of complexity and demands on pre-understanding. The material for school children is at present being tested in the partner countries. Already, the portal and the material have been very well accepted among pupils and schoolteachers and they have found it interesting as course material in different subjects. The portal design has also been highly appreciated due to its attractiveness and exciting approach with "clouds". Many users have confirmed that they use a lot of applications but didn't know there was GIS behind it. Now they wish to learn more and to go further into details. This cannot be better expressed and is explicitly what eGIS+ is about.

eGIS+ is born; with rich fertilising it will grow, inspire people and society and become sustainable!

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